United States
Department of
Agriculture

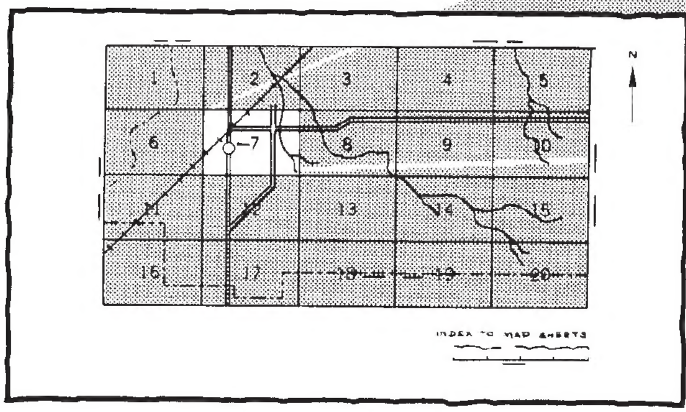
Soil
Conservation
Service

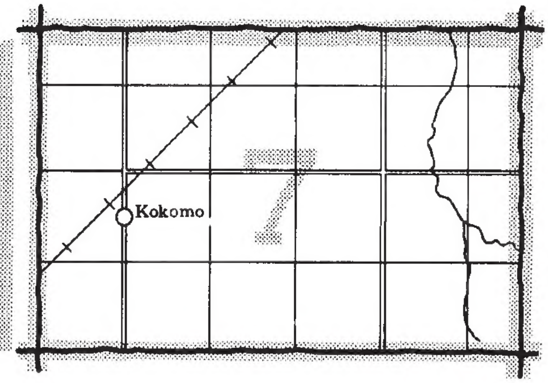
In cooperation with
Michigan Agricultural
Experiment Station

Soil Survey of Branch County, Michigan

HOW TO USE

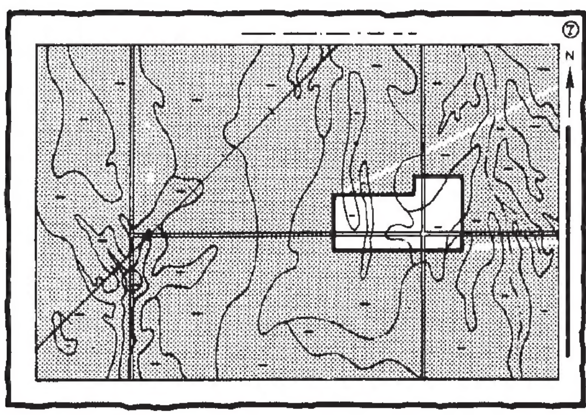
1. Locate your area of interest on the "Index to Map Sheets."

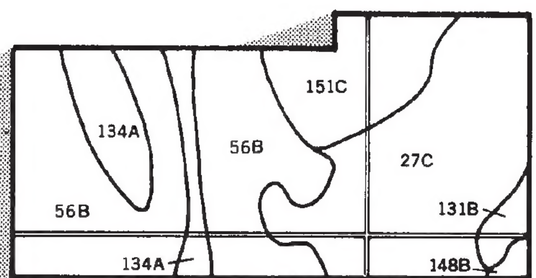




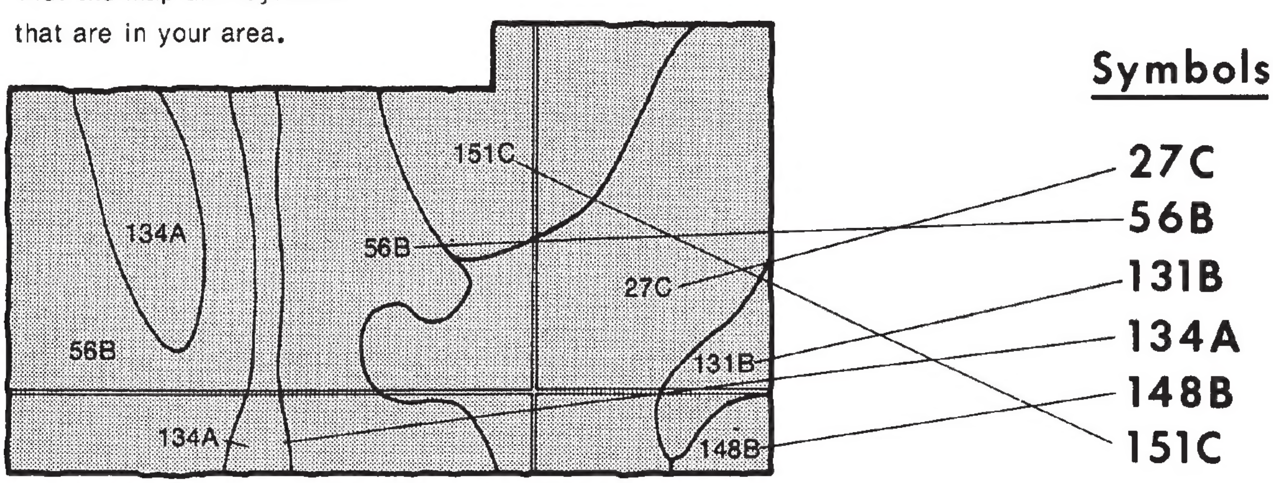
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



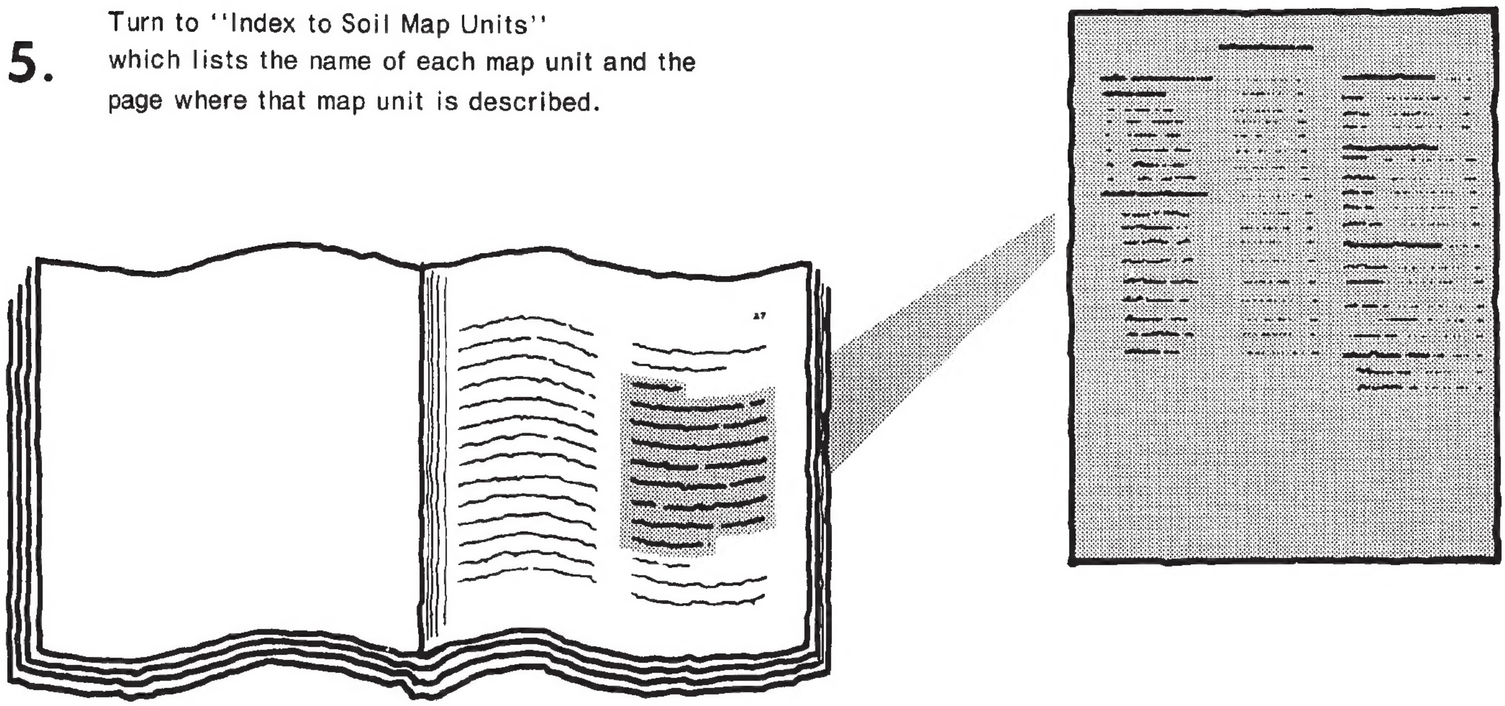


4. List the map unit symbols that are in your area.

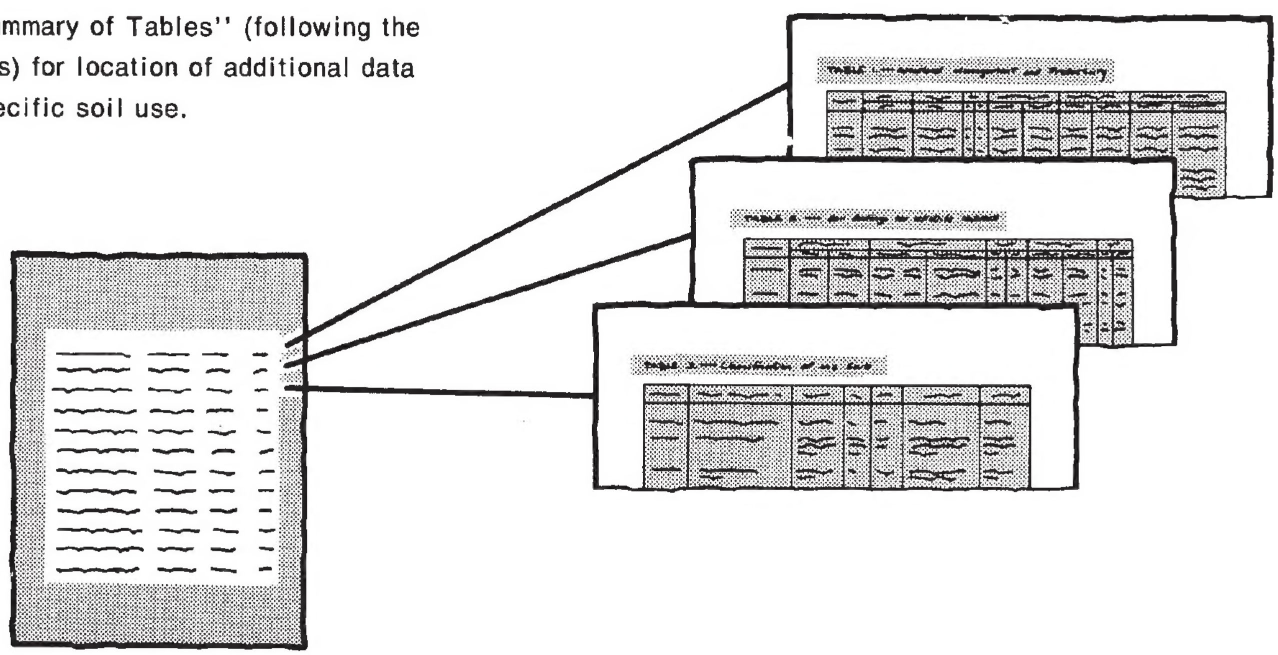


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service and the Michigan Agricultural Experiment Station. It is part of the technical assistance furnished to the Branch County Soil Conservation District. Financial assistance was made available by the Branch County Board of Commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: An area of Fox sandy loam, 0 to 2 percent slopes, used for corn, the major crop in Branch County.

Contents

Soil Series

Issued September 1986

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Branch County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Homer R. Hilner

Homer R. Hilner
State Conservationist
Soil Conservation Service

Location of Branch County in Michigan.

Soil Survey of
Branch County, Michigan

By Gregory F. Thoen and Ronald W. Olson, Soil Conservation Service

Fieldwork by Ronald W. Olson and Gregory F. Thoen,
Soil Conservation Service, and Gay Lynn Kinter, James G. Robinson,
and Martin L. Kroell III, Branch County

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Michigan Agricultural Experiment Station

BRANCH COUNTY is in the south-central part of the Lower Peninsula of Michigan. It has an area of 332,243 acres, or about 519 square miles. Coldwater is the county seat and the commercial, industrial, and educational center of the county. The population of the county in 1980 was about 40,105.

About 80 percent of the land in the county is used for cash crops, dairying, and other farm enterprises. The chief cash crop is corn. About 17 percent of the land is woodland. About 3 percent is urban and built-up land (*8*).

There are about 27 different kinds of soil in the county. The soils range widely in texture, natural drainage, slope, and other characteristics. Well drained soils make up about 36 percent of the county; moderately drained soils about 6 percent; somewhat poorly drained soils about 30 percent; poorly drained and very poorly drained, mineral soils about 16 percent; and very poorly drained, organic soils about 9 percent. The rest of the county is miscellaneous areas and water areas.

This survey updates the soil survey of Branch County published in 1928 (*7*). It provides additional information and larger maps, which show the soils in greater detail.

General Nature of the County

This section provides general information about Branch County. It describes climate, history and development, and agriculture.

Climate

Prepared by the Michigan Department of Agriculture, Climatology Division, East Lansing, Michigan.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Coldwater in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 25.0 degrees F, and the average daily minimum temperature is 17.0 degrees. The lowest temperature on record, which occurred at Coldwater on February 20, 1929, is -22 degrees. In summer the average temperature is 69.1 degrees, and the average daily maximum temperature is 80.7 degrees. The highest recorded temperature, which occurred at Coldwater on July 24, 1934, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 33.49 inches. Of this, 20.68 inches, or about 62 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 16.7 inches. The heaviest 1-day rainfall during the period of record was 5.37 inches at Coldwater on June, 26, 1978.

Thunderstorms occur on about 39 days each year, and most occur in June.

The average seasonal snowfall is 47.8 inches. The greatest snow depth at any one time during the period of record was 30 inches, on January 29 and 30, 1978. On the average, 63 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The greatest seasonal snowfall was 84.8 inches, during the winter of 1977-78, and the lowest seasonal snowfall was 13.9 inches, during the winter of 1948-49. The heaviest 1-day snowfall on record was more than 17.0 inches, on January 26, 1978. The greatest monthly snowfall, 50.7 inches, was in January of 1978.

Based on data recorded at Lansing, Michigan, and South Bend, Indiana, the average relative humidity in midafternoon is about 64 percent. Humidity is higher at night, and the average at dawn is about 84 percent. At Lansing the sun shines 67 percent of the time possible in summer and 37 percent in winter. At Lansing, the prevailing wind is from the southwest and the average windspeed is highest, 12.1 miles per hour, in January. At South Bend, the prevailing wind is from the south-southwest and the average windspeed is highest, 12.3 miles per hour, in March.

History and Development

In 1821, the Potawatomi Indians sold large tracts of land, including the area now known as Branch County, to settlers. Between 1829 and 1831, a school, a sawmill, and roads were built in the county. Farmers migrating from the east found the prairies in the area attractive. The St. Joseph River became a growing avenue of commerce for the freight barges navigating the 175 river miles between the county and Lake Michigan. Lumbering and agriculture were the primary economic activities prior to 1840.

Between 1830 and 1880, about 3,700 scattered farm homes were constructed throughout the county. Coldwater, Quincy, Bronson, and Union City grew as trade and service centers. Lumber mills and wood-fabricating plants thrived on the native hardwood forests. In 1853, a railroad was extended through Coldwater. Soon after this date, the first lake cottages were built on the shores of the lakes near Coldwater.

Near the turn of the century, Coldwater shale was discovered in the county. This discovery had a significant effect on the development of the county until 1945. The shale was a valuable ingredient in the manufacture of portland cement. Cement plants at Bronson, Coldwater, Quincy, and Union City were among the first cement producers in Michigan. The replacement of shale by limestone as an ingredient in cement production led to the decline of the cement industry in Branch County.

In the late 1800's and the early 1900's, lumber mills and wood industries went into decline because less land was cleared for farming. Also, larger, more efficient farms reduced the number of farmers. Following World War I, economic activity and the population began to grow again, but in a different pattern from that of the earlier years. In response to industrialization and the age of the automobile, urban and suburban development occurred in and around towns and villages, along the county roads, at highway intersections, and along lakefronts.

Since 1930, the population has continued to grow in most areas. In 1969, at least a third of all families in every township were nonfarm families. Better roads and more industrialization have had a considerable influence on the development of the county (*12*).

Agriculture

The pioneer farmers mainly grew subsistence crops. The earliest sources of income were principally farm produce, cattle, furs, and lumber. Development was slow until 1835 and 1836, when the influx of settlers increased very rapidly. The county population reached 5,715 by 1840 and nearly doubled during each of the next two decades.

As the population grew, the acreage of cultivated land increased at an extremely rapid rate. Wheat was the principal cash crop, corn was an important subsistence crop, and potatoes and other food crops were grown largely to supply local demands. In 1852, the first railroad was built through the county, connecting Chicago with Lake Erie. This direct outlet to distant markets gave new impetus to agricultural development. Cash incomes were subsequently derived from a greater variety of sources.

The population and the cultivated acreage steadily increased until 1880, when the county had 27,941 inhabitants and 3,670 farms. The acreage of farmland was 96.9 percent of the total area in the county. At that time, corn, wheat, oats, potatoes, and hay were the principal crops, and buckwheat, rye, and barley were minor crops (*4*).

By 1930, significant changes had been brought about in the farming system. The average size of farms had increased, and the use of lime and chemical fertilizers had been introduced. Barley and rye had partly replaced wheat, and alfalfa had become an important hay crop, at the expense of timothy. More hay and forage was now being produced and consumed on the farm because dairying had become the principal source of farm income. To increase crop production, farmers began to rely less on the natural productivity of the soil and more on lime, commercial fertilizer, proper varieties of seed, crop rotation, incorporation of organic matter into the soil, and artificial drainage.

Between the 1930's and the present, farming shifted somewhat from livestock to cash crops, mainly corn, soybeans, and wheat. Sprinkler irrigation was a

significant factor in making this shift possible. About 15,000 acres currently is used for hay and pasture (*4*).

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some of the boundaries on the general soil map of Branch County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences result from modifications or refinements in soil series concepts and variations in the intensity of mapping or in the extent of the soils within the counties.

Soil Descriptions

1. Hatmaker-Locke-Barry Association

Level to undulating, somewhat poorly drained and poorly drained, loamy soils on till plains and moraines

The Hatmaker and Locke soils are generally in the higher landscape positions. The Barry soils are on low plains and in depressional areas. Slope ranges from 1 to 4 percent.

This association makes up about 6 percent of the county. It is about 40 percent Hatmaker soils, 30 percent Locke soils, 15 percent Barry soils, and 15 percent soils of minor extent (fig. 1).

Hatmaker soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is pale olive, mottled loam about 7 inches thick. The subsoil is firm, mottled silt loam about 24 inches thick. The upper part is olive, and the lower part is gray and dark gray. The substratum to a depth of about 60 inches is dark grayish brown, mottled, firm calcareous shaly silt loam.

Locke soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 22 inches thick. It is mottled and friable. The upper part is dark yellowish brown sandy clay loam, and the lower part is yellowish brown loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable, calcareous sandy loam.

Barry soils are level and poorly drained. Typically, the surface layer is very dark gray loam about 12 inches thick. The subsoil is about 26 inches thick. It is mottled. The upper part is dark grayish brown, firm clay loam; the next part is gray, firm loam; and the lower part is light brownish gray, friable loam. The substratum to a depth of about 60 inches is light brownish gray, yellowish brown, and brownish yellow, firm, calcareous sandy loam.

Of minor extent in this association are the well drained Hillsdale and Riddles and somewhat poorly drained Teasdale soils. Hillsdale and Riddles soils are on the higher knolls and ridges. Teasdale soils are coarser textured than the Hatmaker and Locke soils. They are in midslope landscape positions.

Most areas in this association are used as cropland. A few areas are used for pasture or support a permanent cover of vegetation, including trees. Water erosion, excess water, and soil blowing are the major management concerns.

The major soils are well suited to crops, such as corn, soybeans, and winter wheat. They are well suited to pasture. They are poorly suited or are generally unsuited to septic tank absorption fields and buildings. Wetness is the main limitation. Ponding is a hazard on the Barry soils.

2. Fox-Oshtemo-Ormas Association

Nearly level to moderately steep, well drained, loamy and sandy soils on outwash plains and moraines

These soils are on broad flats, low knolls, and ridges. Slope ranges from 0 to 25 percent.

This association makes up about 20 percent of the county. It is about 35 percent Fox soils, 25 percent Oshtemo soils, 15 percent Ormas soils, and 25 percent soils of minor extent.

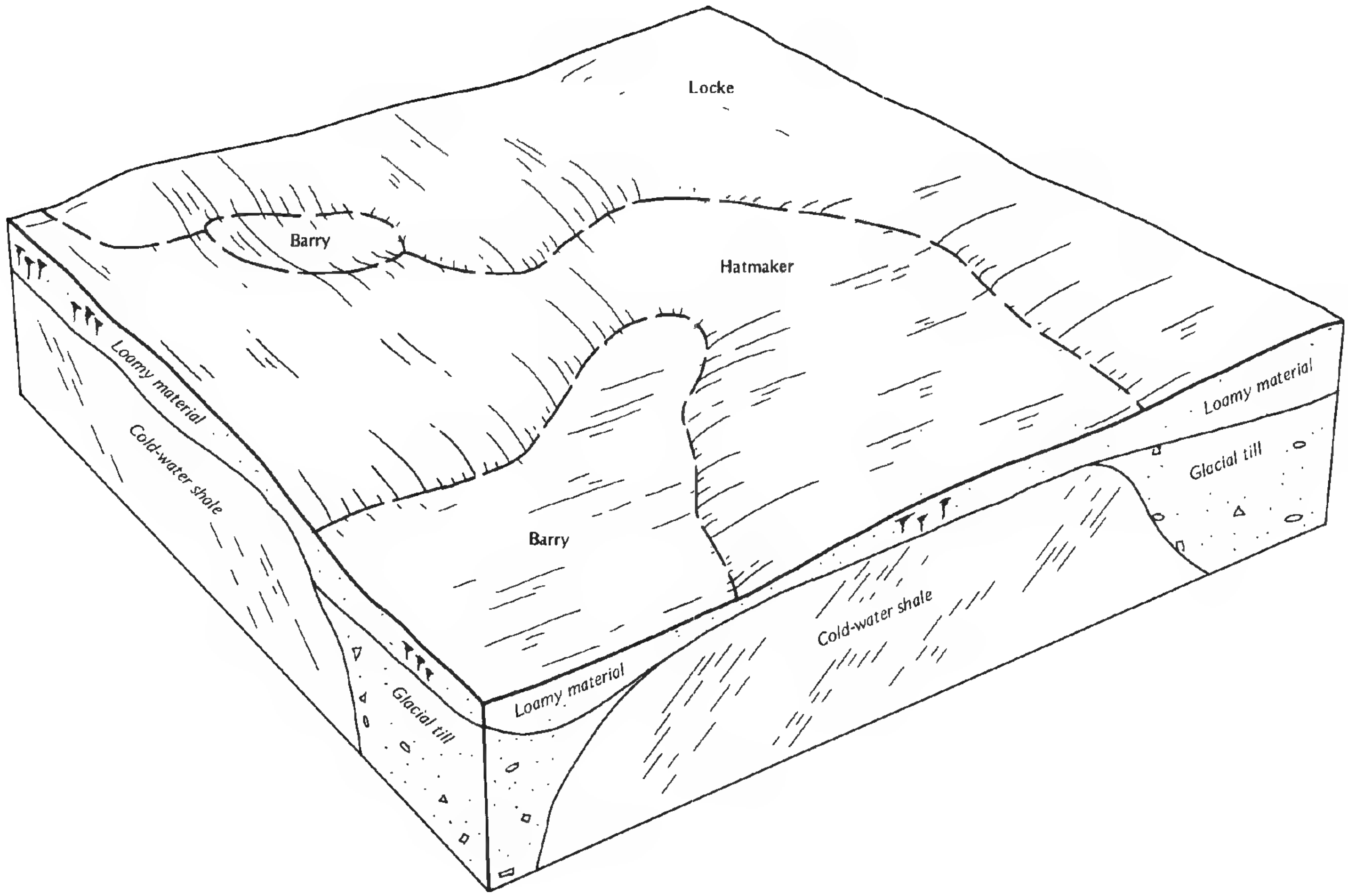


Figure 1.—Pattern of soils and underlying material in the Hatmaker-Locke-Barry association.

Fox soils are nearly level to moderately sloping. Typically, the surface layer is brown sandy loam about 11 inches thick. The subsurface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, firm and friable gravelly clay loam. The lower part is dark yellowish brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose, calcareous very gravelly sand.

Oshtemo soils are nearly level to moderately steep. Typically, the surface layer is dark grayish brown sandy loam about 11 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown, friable sandy loam, the next part is dark brown, friable sandy clay loam and sandy loam, and the lower part is dark yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous gravelly sand.

Ormas soils are nearly level and gently sloping. Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsurface layer is yellowish brown, friable loamy sand about 21 inches thick. The subsoil is dark yellowish brown, firm and friable sandy loam about 22 inches thick. The substratum to a depth of about 60 inches is dark brownish yellow, loose, calcareous sand.

Of minor extent in this association are the Branch, Bronson, Brady, and Gilford soils. The moderately well drained Branch and Bronson soils are in the lower landscape positions. The somewhat poorly drained Brady and poorly drained Gilford soils are on low flats and in drainageways.

Most areas in this association are used as cropland. A few areas, mostly the steeper ones, are used for pasture or support a permanent cover of vegetation, including trees. Water erosion and soil blowing are major management concerns.

The major soils generally are fairly well suited or well suited to pasture and to crops, such as corn, soybeans, and winter wheat. The hilly Oshtemo soils, however, are

unsuitable for crops and pasture. The Oshtemo and Ormas soils are generally well suited to septic tank absorption fields and building site development. The hilly Oshtemo soils, however, are unsuitable for these uses because of the slope. The Fox soils generally are fairly well suited to septic tank absorption fields and buildings. A poor filtering capacity and the slope are the main limitations.

3. Fox-Houghton-Edwards Association

Nearly level to moderately sloping, well drained, loamy soils on outwash plains and moraines and level, very poorly drained, mucky soils in swamps, depressions, and drainageways

The Fox soils are on broad upland flats, knolls, and ridges. The Houghton and Edwards soils are in low depressional areas, swamps, and drainageways. Slope ranges from 0 to 12 percent.

This association makes up about 12 percent of the county. It is about 65 percent Fox soils, 12 percent Houghton soils, 11 percent Edwards soils, and 12 percent soils of minor extent.

Fox soils are nearly level to moderately sloping and are well drained. Typically, the surface layer is brown sandy loam about 11 inches thick. The subsurface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, firm and friable gravelly clay loam. The lower part is dark yellowish brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose, calcareous very gravelly sand.

Houghton soils are level or slightly depressional and are very poorly drained. Typically, the surface layer is black muck about 9 inches thick. Below this to a depth of about 60 inches is very dark brown and black muck.

Edwards soils are level or slightly depressional and are very poorly drained. Typically, the surface layer is black muck about 6 inches thick. Below this is black, friable muck about 18 inches thick. The substratum to a depth of about 60 inches is grayish brown marl.

Of minor extent in this association are the somewhat poorly drained Matherton and poorly drained Sebewa soils. Matherton soils are in landscape positions slightly lower than those of the Fox soils. Sebewa soils are in landscape positions slightly higher than those of the Houghton and Edwards soils.

Most areas of the Fox soils in this association are used as cropland. The steeper areas and the undrained mucks are used for pasture or support a permanent cover of vegetation, including trees. Water erosion and soil blowing are the major management concerns on the Fox soils. Wetness and ponding are the major management concerns on the Houghton and Edwards soils.

The Fox soils in this association are well suited or fairly well suited to crops, such as corn, soybeans, wheat, and alfalfa. They are well suited to pasture. The Houghton and Edwards soils are generally unsuited to crops and are poorly suited to pasture because suitable drainage outlets are not available in most areas. The Fox soils are fairly well suited to septic tank absorption fields and buildings. A poor filtering capacity and the slope are the main limitations. The Houghton and Edwards soils are generally unsuitable for septic tank absorption fields and buildings. Wetness and ponding are the main limitations.

4. Matherton-Sebewa-Branch Association

Level to gently sloping, moderately well drained to poorly drained, loamy and sandy soils on outwash plains and moraines

The Branch soils are generally in the higher landscape positions. The Matherton soils are in the slightly higher landscape positions. The Sebewa soils are on low flats and in depressions. Slope ranges from 0 to 4 percent.

This association makes up about 15 percent of the county. It is about 35 percent Matherton soils, 25 percent Sebewa soils, 10 percent Branch soils, and 30 percent soils of minor extent.

Matherton soils are nearly level and somewhat poorly drained. Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsoil is about 18 inches thick. It is brown, mottled, and friable. The upper part is clay loam, and the lower part is gravelly clay loam. The substratum to a depth of about 60 inches is light yellowish brown, loose gravelly sand.

Sebewa soils are level and poorly drained. Typically, the surface layer is very dark gray loam about 12 inches thick. The subsoil is about 19 inches thick. It is mottled. The upper part is grayish brown, firm loam, and the lower part is dark gray, friable loam. The substratum to a depth of about 60 inches is grayish brown, loose, calcareous sand.

Branch soils are nearly level and gently sloping and are moderately well drained. Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is dark yellowish brown and yellowish brown loamy sand and sand about 19 inches thick. The subsoil is mottled, friable sandy loam about 29 inches thick. The upper part is dark yellowish brown, the next part is yellowish brown, and the lower part is dark brown. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous gravelly sand.

Of minor extent in this association is the very poorly drained Cohoctah, Gilford, and Adrian soils and the somewhat poorly drained Brady soils. Cohoctah soils are along the major drainageways. Gilford and Adrian soils are in positions on the landscape similar to those of the Sebewa soils. Brady soils are coarser textured than the Matherton soils. They are in positions on the landscape similar to those of the Matherton soils.

Most areas of this association are used as cropland. A few areas, mostly those that are poorly drained or very

poorly drained, are used for pasture or support a permanent cover of vegetation, including trees. Excess water, soil blowing, and droughtiness are the major management concerns.

The major soils are fairly well suited or well suited to crops, such as corn, soybeans, and winter wheat. Most of these soils are well suited or fairly well suited to pasture. Most are poorly suited or unsuited to septic tank absorption fields and buildings. The moderately well drained Branch soils, however, are fairly well suited to buildings. A poor filtering capacity and the wetness are the main limitations. Ponding is a hazard on the Sebewa soils.

5. Locke-Barry-Hillsdale Association

Level to moderately sloping, somewhat poorly drained, poorly drained, and well drained, loamy soils on till plains and moraines

The Hillsdale soils are generally in the higher landscape positions. The Locke soils are in the intermediate landscape positions. The Barry soils are on low plains and in depressional areas. Slope ranges from 0 to 12 percent.

This association makes up about 45 percent of the county. It is about 40 percent Locke soils, 15 percent Barry soils, 15 percent Hillsdale and similar soils, and 30 percent soils of minor extent.

Locke soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 22 inches thick. It is mottled. The upper part is dark yellowish brown, friable sandy clay loam, and the lower part is yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, friable, calcareous sandy loam.

Barry soils are level and poorly drained. Typically, the surface layer is very dark gray loam about 12 inches thick. The subsoil is mottled loam about 26 inches thick. The upper part is dark grayish brown and firm, the next part is gray and firm, and the lower part is light brownish gray and friable. The substratum to a depth of about 60 inches is light brownish gray, yellowish brown, and brownish yellow, firm, calcareous sandy loam.

Hillsdale soils are nearly level to gently rolling or moderately sloping. They are well drained. Typically, the surface layer is very dark grayish brown, firm sandy loam about 6 inches thick. The subsurface layer is yellowish brown, firm sandy loam about 5 inches thick. The subsoil is about 55 inches thick. The upper part is yellowish brown, friable and firm fine sandy loam, and the lower

Figure 2.—Pastured area of Locke and Barry soils in the Locke-Barry-Hillsdale association. Hillsdale soils are in the background.

part is dark yellowish brown, friable sandy loam. The substratum to a depth of about 70 inches is yellowish brown, friable, calcareous sandy loam.

Of minor extent in this association are Riddles, Elmdale, and Teasdale soils. The well drained Riddles soils are finer textured than the Hillsdale soils and are in the higher positions on the landscape. The moderately well drained Elmdale soils are slightly lower on the landscape than the Hillsdale soils. Teasdale soils are coarser textured than the Locke soils. They are in positions on the landscape slightly higher than those of the Barry soils.

Most areas of this association are used as cropland. A few areas, mostly the steeper ones, are used for pasture or support a permanent cover of vegetation, including trees. Excess water, water erosion, and soil blowing are the major management concerns.

The major soils generally are well suited to crops, such as corn, soybeans, and winter wheat. The more sloping soils, however, are only fairly well suited to these crops. Most of the soils are well suited to pasture, but the poorly drained Barry soils are only fairly well suited (fig. 2). Most of the soils are poorly suited or unsuited to septic tank absorption fields and buildings. Wetness is the main limitation. Ponding is a hazard on the Barry soils. The well drained Hillsdale soils are well suited or fairly well suited to septic tank absorption fields and buildings. Slope is the main limitation.

6. Morley-Locke-Houghton Association

Nearly level to gently rolling, well drained and somewhat poorly drained, silty and loamy soils on till plains and moraines and level, very poorly drained, mucky soils in swamps and depressions

The Morley soils are generally on upland side slopes and ridges. Locke soils are in the slightly lower positions on the landscape. Houghton soils are in low depressions and swamps. Slope ranges from 0 to 12 percent.

This association makes up about 2 percent of the county. It is about 34 percent Morley soils, 30 percent Locke soils, 15 percent Houghton soils, and 21 percent soils of minor extent (fig. 3).

Morley soils are nearly level to gently rolling and are well drained. Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 18 inches thick. The upper part is brown, friable silt loam, and the lower part is brown and yellowish brown, firm silty clay loam. The substratum to a depth of about 60 inches is brown, firm silty clay loam.

Locke soils are nearly level and undulating and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 22 inches thick. It is mottled. The upper part is dark yellowish brown, friable sandy clay loam, and the lower part is yellowish brown, friable loam. The substratum to a depth of about 60 inches is yellowish, mottled, friable, calcareous sandy loam.

Houghton soils are level or slightly depressional and are very poorly drained. Typically, the surface layer is black muck about 9 inches thick. Below this to a depth of about 60 inches is very dark brown and black muck.

Of minor extent in this association are the well drained Riddles and poorly drained Barry soils. Riddles soils are coarser textured and deeper to carbonates than the Morley soils. They are on the upland side slopes and ridges. Barry soils are slightly lower on the landscape than the Locke soils.

Most areas of this association are used as cropland. A few areas, mostly the steeper ones, are used for pasture. The undrained mucks support a cover of native vegetation. Water erosion and soil blowing are the major management concerns on the upland soils.

The Morley and Locke soils in this association are well suited or fairly well suited to crops, such as corn, soybeans, winter wheat, and alfalfa. They are well suited to pasture. The Morley soils are fairly well suited to buildings. The slope and the shrink-swell potential are the major management concerns. The Locke soils are poorly suited to buildings because of a seasonal high water table. The Houghton soils are generally unsuited to buildings and septic tank absorption fields because of ponding. The Morley and Locke soils are poorly suited to septic tank absorption fields. The moderately slow permeability of the Morley soils and the wetness of the Locke soils are the major management concerns.

Broad Land Use Considerations

The general soil map in this soil survey can be used in planning land use at the township or county level. Approximately 85 percent of the acreage in Branch County is agricultural land, 10 percent is woodland, and 5 percent is urban land. The soils in the county are well suited to cultivated crops, pasture, and woodland. They are fairly well suited or poorly suited to urban development. Corn and soybeans are the main crops. Urban development is centered around Coldwater, Bronson, and Quincy and along most of the lakes.

All of the associations are used to a major extent for cultivated crops. The soils in associations 3 and 4 are less well suited to cultivated crops and pasture than the soils in the other associations. The major soils in associations 2 and 3 are the Fox, Oshtemo, Ormas, Houghton, and Edwards soils. Droughtiness is the main management concern on the Fox, Oshtemo, and Ormas soils. If adequate sources of water are available, these soils can be irrigated. Field size is commonly increased to accommodate the irrigation equipment. As a result, the hazard of soil blowing is increased. Houghton and Edwards soils are generally unsuited to cultivated crops unless excess water is removed. Suitable drainage outlets generally are not available, and the soils in many undrained areas are in marshes or woods. These areas can serve as sources of water for irrigation.

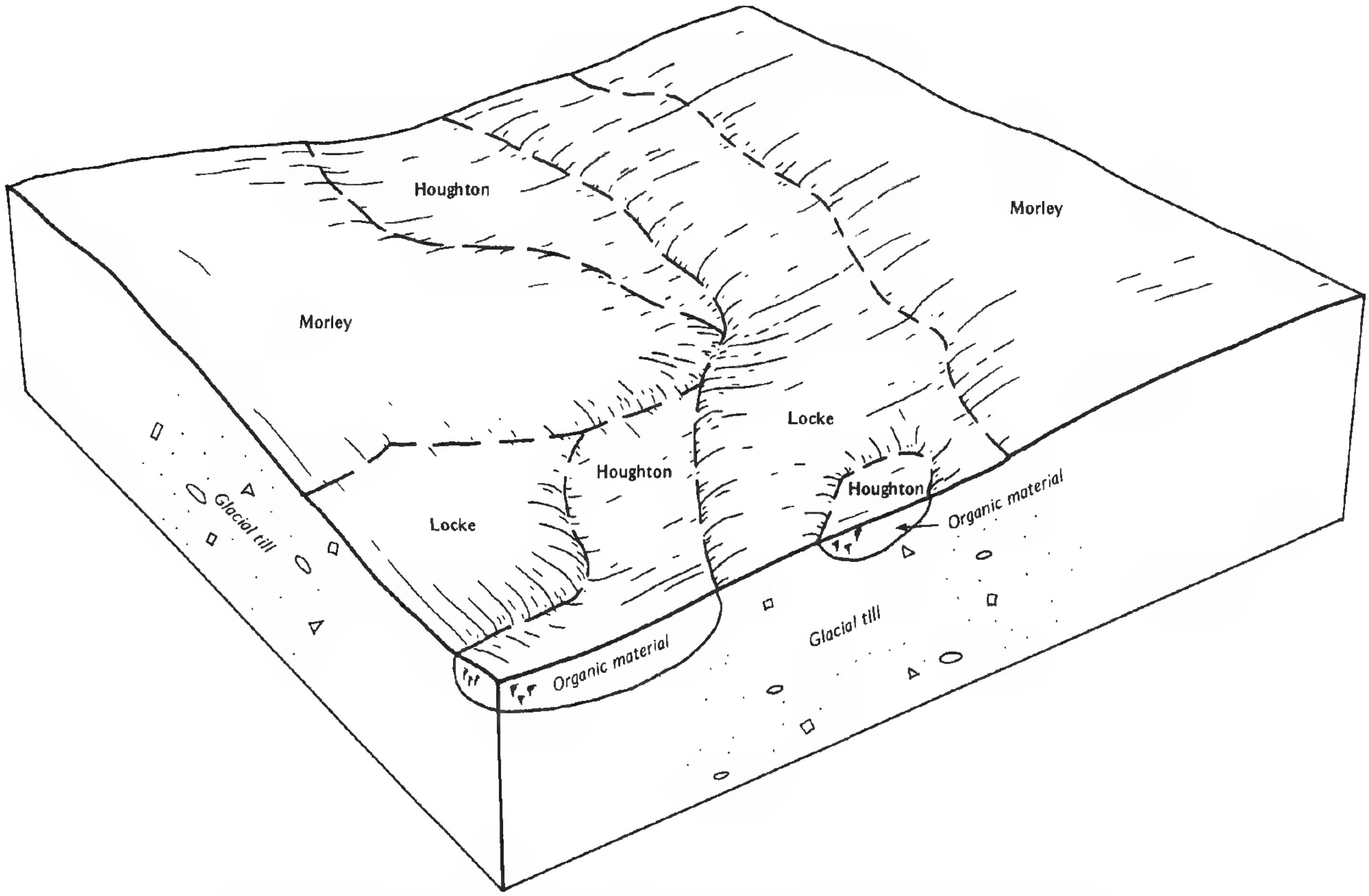


Figure 3.—Pattern of soils and underlying material in the Morley-Locke-Houghton association.

Hatmaker, Locke, Barry, and Hillsdale are the major soils in associations 1 and 5. Wetness is the main limitation on the Hatmaker, Locke, and Barry soils. Suitable drainage outlets are generally available. Water erosion is a hazard on the Hatmaker, Locke, and Hillsdale soils. Also, Locke and Hillsdale soils are susceptible to soil blowing.

Matherton, Sebewa, and Branch are the major soils in association 4. Wetness is the main limitation on the Matherton and Sebewa soils. Suitable outlets for excess water are generally available. Soil blowing is a hazard on the Matherton and Branch soils. The major soils in association 6 are the Morley, Locke, and Houghton soils. Most areas of the Houghton soils support native vegetation because suitable outlets for the removal of excess water are not available. Water erosion is a hazard on the Morley and Locke soils. Soil blowing is a hazard on the Locke soils.

The major soils in associations 1, 2, 4, 5, and 6 are well suited to timber production. Commercially valuable hardwoods are grown in many woodlots on these soils. The major soils in association 3 are fairly well suited to timber production. Wetness restricts the use of logging equipment on the Houghton and Edwards soils. The seedling survival rate on these soils is low, and the windthrow hazard is high. The species that are harvested are suitable mainly for pulpwood.

The major soils in associations 1, 3, 4, 5, and 6 generally are poorly suited to sanitary facilities and building site development. Wetness is the major limitation. Moderately slow or slow permeability further limits the use of the Morley soils in association 6 for sanitary facilities, and the shrink-swell potential limits the use of these soils as building sites. A poor filtering capacity and seepage further limit the use of the Matherton and Sebewa soils in association 4 for sanitary facilities. The well drained Hillsdale soils in association 5 are well suited to building site development and sanitary facilities in areas where the slope is less than 8 percent

and are fairly well suited in areas where the slope is more than 8 percent.

The major soils in association 2 have few limitations for building site development and sanitary facilities. The importance of these soils as a growing medium for crops, however, should not be overlooked. These soils are underlain by sand and gravelly sand. As a result, seepage and a poor filtering capacity are major management concerns on sites for sanitary facilities.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Fox sandy loam, 6 to 12 percent slopes, is one of several phases in the Fox series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Hillsdale-Riddles fine sandy loams, 2 to 6 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. The Pits in the Pits-Aquents complex is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some of the boundaries on the detailed soil maps of Branch County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences result from modifications or refinements in soil series concepts and variations in the intensity of mapping or in the extent of the soils within the counties.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

2B—Kidder fine sandy loam, 2 to 6 percent slopes. This is an undulating, well drained soil on foot slopes, knolls, and low ridges. It commonly is dissected by shallow drainageways. Areas are irregular in shape and range from 3 to 180 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsoil is about 21 inches thick. The upper part is dark yellowish brown, friable and firm loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, friable, calcareous fine sandy loam. In some areas the depth to calcareous loamy material is more than 40 inches.

Included with this soil in mapping are small areas of Barry, Hillsdale, and Locke soils. Barry soils are poorly drained and are in depressions and narrow drainageways. Hillsdale soils are more droughty than the Kidder soil and are in scattered areas throughout the unit. Locke soils are somewhat poorly drained and are lower on the landscape than the Kidder soil. Included soils make up 3 to 14 percent of the unit.

Permeability is moderate in the upper part of the Kidder soil and moderately rapid in the lower part. Available water capacity is high. Runoff is medium.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion, soil blowing, and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, helps to control water erosion. Cover crops and a system of conservation tillage that does not invert the soil and keeps the maximum amount of crop residue on the surface help to control erosion and soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter.

This soil is well suited to pasture. Proper stocking rates and pasture rotation help keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, can result in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major management hazards or limitations affect planting or harvesting.

This soil is fairly well suited to building site development and is well suited to septic tank absorption fields. The shrink-swell potential is a moderate limitation on sites for buildings without basements. The shrinking and swelling can be controlled by widening the foundation trench and then backfilling with suitable coarse textured material.

The land capability classification is IIe. The Michigan soil management group is 2.5a.

2C—Kidder fine sandy loam, 6 to 12 percent slopes. This is a gently rolling, well drained soil on knolls and low ridges. It commonly is dissected by shallow drainageways. Areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsoil is about 21 inches thick. The upper part is dark yellowish brown, friable and firm loam, and the lower part is yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, friable, calcareous fine sandy loam. In some areas the depth to calcareous loamy material is more than 40 inches.

Included with this soil in mapping are small areas of Barry, Hillsdale, and Locke soils. Barry soils are poorly drained and are in depressions and narrow drainageways. Hillsdale soils are more droughty than the Kidder soil and are in scattered areas throughout the unit. Locke soils are somewhat poorly drained and are lower on the landscape than the Kidder soil. Included soils make up 3 to 15 percent of the unit.

Permeability is moderate in the upper part of the Kidder soil and moderately rapid in the lower part. Available water capacity is high. Runoff is rapid.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion, soil blowing, and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, helps to control water erosion. Cover crops and a system of conservation tillage that does not invert the soil and keeps the maximum amount of crop residue on the surface help to control erosion and soil blowing. Buffer strips and field windbreaks reduce the susceptibility to soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter.

This soil is well suited to pasture. Overgrazing is the major management concern. Proper stocking rates and pasture rotation help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, can result in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is fairly well suited to building site development and septic tank absorption fields. The slope is the main limitation. The shrink-swell potential also is a concern on building sites. Buildings constructed can be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Widening the foundation trench and then backfilling with suitable coarse textured material help to overcome the shrink-swell potential. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IIIe. The Michigan soil management group is 2.5a.

4B—Oshtemo sandy loam, 0 to 6 percent slopes. This is a nearly level and gently sloping, well drained soil on broad flats, low knolls, and ridges. Areas are irregular in shape and range from 3 to 800 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 11 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown, friable, sandy loam; the next part is dark brown, friable, sandy clay loam and sandy loam; and the lower part is dark yellowish brown, very friable, loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous gravelly sand. In some areas the surface layer is sand and is more than 20 inches thick. In other areas the calcareous gravelly sand substratum is at a depth of less than 40 inches.

Included with this soil in mapping are small areas of Brady, Gilford, and Spinks soils. Brady soils are somewhat poorly drained and are on side slopes and

foot slopes. Gilford soils are very poorly drained and are in depressions and narrow drainageways. The sandy Spinks soils are more droughty than the Oshtemo soil and are in scattered areas throughout the unit. Included soils make up 4 to 14 percent of the unit.

Permeability is moderately rapid in the Oshtemo soil. Available water capacity is moderate. Runoff is very slow to medium.

Most areas of this soil are used for crops. A few are used for pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn (fig. 4), soybeans, and winter wheat. Soil blowing, droughtiness, and the organic matter content are the major management concerns. A system of conservation tillage that does not invert the soil and keeps the maximum amount of crop residue on the surface helps to control soil blowing and conserves moisture. Buffer strips and field windbreaks reduce the susceptibility to soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration. Irrigation may be needed when moisture levels are low.

This soil is fairly well suited to pasture. Droughtiness and overgrazing during dry periods are the main management concerns. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland, building site development, and septic tank absorption fields. No major hazards or limitations affect these uses.

The land capability classification is IIIs. The Michigan soil management group is 3a.

4C—Oshtemo sandy loam, 6 to 12 percent slopes. This is a moderately sloping, well drained soil on knolls and low ridges. Areas are irregular in shape and range from 3 to 110 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 11 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown, friable sandy loam; the next part is dark brown, friable sandy clay loam and sandy loam; and the lower part is dark yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous gravelly sand. In some areas the surface layer is sand and is more than 20 inches thick. In other areas the calcareous gravelly sand substratum is at a depth of less than 40 inches.

Included with this soil in mapping are small areas of Brady, Gilford, and Spinks soils. Brady soils are somewhat poorly drained and are on side slopes and foot slopes. Gilford soils are very poorly drained and are in depressions and narrow drainageways. The sandy

Figure 4.—An area of Oshtemo sandy loam, 0 to 6 percent slopes, used for corn.

Spinks soils are more droughty than the Oshtemo soil and are in scattered areas throughout the unit. Included soils make up 3 to 15 percent of the unit.

Permeability is moderately rapid in the Oshtemo soil. Available water capacity is moderate. Runoff is rapid.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn, soybeans, and winter wheat. Water erosion, soil blowing, droughtiness, and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, helps to control water erosion. A system of conservation tillage that does not invert the soil and keeps the maximum amount of crop residue on the surface helps to control erosion and soil blowing and conserves moisture. Buffer strips and field windbreaks reduce the susceptibility to soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration. Irrigation may be needed when moisture levels are low. Seeding the irrigation equipment lanes helps to control erosion.

This soil is fairly well suited to pasture. Droughtiness and overgrazing during dry periods are the major management concerns. Pasture rotation, proper stocking rates, and restricted use during dry periods help to prevent overgrazing. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the slope, this soil is only fairly well suited to building site development and septic tank absorption fields. Buildings can be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IIIe. The Michigan soil management group is 3a.

4E—Oshtemo sandy loam, 12 to 25 percent slopes. This is a strongly sloping and moderately steep, well drained soil on knolls and ridges. Areas are irregular in shape and range from 3 to 45 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 11 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown, friable sandy loam; the next part is dark brown, friable sandy clay loam and sandy loam; and the lower part is dark yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous gravelly sand. In some areas the surface layer is sand and is more than 20 inches thick. In other areas the calcareous gravelly sand substratum is at a depth of less than 40 inches.

Included with this soil in mapping are small areas of the sandy Spinks soils. These soils are more droughty than the Oshtemo soil and are in scattered areas throughout the unit. They make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Oshtemo soil. Available water capacity is moderate. Runoff is very rapid.

Most areas are used as woodland (fig. 5). A few have a cover of permanent vegetation other than trees. This soil is generally unsuitable for crops and pasture because of the slope and a severe hazard of water erosion.

This soil is well suited to woodland. The erosion hazard and the equipment limitation are the major management concerns on slopes of more than 18 percent. Establishing logging roads and skid trails on the gentler slopes helps to control erosion and helps to overcome the equipment limitation.

Because of the slope, this soil is generally unsuited to septic tank absorption fields and building site development.

The land capability classification is VIe. The Michigan soil management group is 3a.

5B—Hillsdale-Riddles fine sandy loams, 2 to 6 percent slopes. These undulating, well drained soils are on knolls and low ridges. The Hillsdale soil has less clay in the subsoil than the Riddles soil. Areas are irregular in shape and range from 3 to 240 acres in size. They are 40 to 50 percent Hillsdale soil and 35 to 45 percent Riddles soil. The two soils occur as areas so intricately mixed or so small that mapping them separately at the scale used is not practical.

Typically, the Hillsdale soil has a surface layer of very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is yellowish brown fine sandy loam about 5 inches thick. The subsoil is about 55 inches thick. The upper part is yellowish brown, friable and firm, fine sandy loam, and the lower part is dark yellowish brown, friable sandy loam. The substratum to a depth of about 70 inches is yellowish brown, friable, calcareous sandy loam. In some areas calcareous soil material is at a depth of less than 40 inches.

Typically, the Riddles soil has a surface layer of very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is brownish yellow fine sandy loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown and dark yellowish brown, firm loam, and the lower part is dark yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, friable, calcareous fine sandy loam. In some areas, calcareous loamy material is at a depth of less than 40 inches.

Figure 5.—A wooded area of Oshtemo sandy loam, 12 to 25 percent slopes, adjacent to a very poorly drained muck.

Included with these soils in mapping are small areas of Barry, Elmdale, Locke, and Teasdale soils. Barry soils are poorly drained and are in depressions or narrow drainageways. Elmdale soils are moderately well drained and are slightly lower on the landscape than the Hillsdale and Riddles soils. Locke and Teasdale soils are somewhat poorly drained and are much lower on the landscape than the Hillsdale and Riddles soils. Included soils make up 7 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the Hillsdale soil and moderate in the Riddles soil. Available water capacity is high in both soils. Runoff is slow or medium.

Most areas of these soils are used for crops. A few are used as pasture and have a permanent cover of vegetation, including trees.

These soils are well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion, soil blowing, and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, reduces the susceptibility to water erosion. Cover crops and a system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface help to control erosion and soil blowing. Buffer strips and field windbreaks help to prevent excessive soil blowing Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration.

These soils are well suited to pasture. Overgrazing during long dry periods is the major management concern. Grazing should be deferred during these periods. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

These soils are well suited to woodland. No major hazards or limitations affect planting or harvesting.

The Hillsdale soil is well suited to building site development, but the Riddles soil is only fairly well suited because of the shrink-swell potential. Widening the foundation trench and then backfilling with suitable coarse textured material help to prevent the structural

damage caused by shrinking and swelling. Both soils are well suited to septic tank absorption fields.

The land capability classification is IIe. The Michigan soil management groups are 3a and 2.5a.

5C—Hillsdale-Riddles fine sandy loams, 6 to 12 percent slopes. These gently rolling, well drained soils are on knolls and low ridges. The Hillsdale soil has less clay in the subsoil than the Riddles soil. Areas are irregular in shape and range from 3 to 50 acres in size. They are 40 to 50 percent Hillsdale soil and 35 to 45 percent Riddles soil. The two soils occur as areas so intricately mixed or so small that mapping them separately at the scale used is not practical.

Typically, the Hillsdale soil has a surface layer of very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is yellowish brown fine sandy loam about 5 inches thick. The subsoil is about 55 inches thick. The upper part is yellowish brown, friable and firm fine sandy loam, and the lower part is dark yellowish brown, friable sandy loam. The substratum to a depth of about 70 inches is yellowish brown, friable, calcareous sandy loam. In some areas calcareous soil material is at a depth of less than 40 inches.

Typically, the Riddles soil has a surface layer of very dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is brownish yellow fine sandy loam about 5 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown and dark yellowish brown, firm loam, and the lower part is dark yellowish brown, friable fine sandy loam. The substratum to a depth of about 60 inches is yellowish brown, friable, calcareous fine sandy loam. In some areas calcareous loamy material is at a depth of less than 40 inches.

Included with these soils in mapping are small areas of Barry, Elmdale, Locke, and Teasdale soils. Barry soils are poorly drained and are in depressions and narrow drainageways. Elmdale soils are moderately well drained and are slightly lower on the landscape than the Hillsdale and Riddles soils. Locke and Teasdale soils are somewhat poorly drained and are much lower on the landscape than the Hillsdale and Riddles soils. Included soils make up 7 to 15 percent of the unit.

Permeability is moderate or moderately rapid in the Hillsdale soil and moderate in the Riddles soil. Available water capacity is high in both soils. Runoff is rapid.

Most areas of these soils are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

These soils are fairly well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion, soil blowing, and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, reduces the susceptibility to water erosion. Cover crops and a system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface help to control erosion and soil blowing. Buffer strips and windbreaks help to prevent excessive soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration.

These soils are well suited to pasture. Overgrazing during long dry periods is the major management concern. Grazing should be deferred during these periods. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

These soils are well suited to woodland. No major hazards or limitations affect planting or harvesting.

Mainly because of the slope, these soils are only fairly well suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. The shrink-swell potential of the Riddles soil is a moderate limitation on sites for dwellings. The shrinking and swelling can be controlled by widening the foundation trench and then backfilling with suitable coarse textured material. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IIIe. The Michigan soil management groups are 3a and 2.5a.

6—Gilford sandy loam. This is a level, very poorly drained soil on broad flats and in drainageways. It is frequently ponded. Areas are irregular in shape and range from 3 to 170 acres in size.

Typically, the surface layer is very dark gray sandy loam about 14 inches thick. The subsoil is friable and firm, grayish brown, mottled sandy loam about 19 inches thick. The upper part of the substratum is grayish brown, mottled, loose loamy sand. The lower part to a depth of about 60 inches is grayish brown and gray, loose gravelly sand. In some areas the dark surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of Brady and Sebewa soils. Brady soils are somewhat poorly drained and are on small ridges and low knolls. Sebewa soils are poorly drained and have a subsoil that is more clayey than that of the Gilford soil. They are in scattered areas throughout the unit. Included soils make up 2 to 13 percent of the unit.

Permeability is moderately rapid in the upper part of the Gilford soil and very rapid in the lower part. Available water capacity is moderate. Runoff is very slow or ponded. The soil has a seasonal high water table near or above the surface from fall to spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

If drained, this soil is fairly well suited to corn, soybeans, winter wheat, and alfalfa. Wetness and soil blowing are the major management concerns. If the soil is drained, droughtiness becomes a management concern. A combination of surface drains and subsurface tile is effective in removing excess water if adequate outlets are available. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface helps to control soil blowing and conserves moisture. Buffer strips and windbreaks also help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter.

This soil is poorly suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Deferment of grazing during excessively wet periods minimizes damage to pasture plants and deterioration of tilth. A suitable legume-grass seeding mixture, such as birdsfoot trefoil, smooth bromegrass, and timothy, results in a long-lived stand that has a long grazing season.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for building site development and onsite waste disposal.

The land capability classification is IIIw. The Michigan soil management group is 4c.

7B—Hatmaker loam, 1 to 4 percent slopes. This is a nearly level and gently sloping, somewhat poorly drained soil on broad flats, low knolls, and ridges. Areas are irregular in shape and range from 3 to 1,650 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is pale olive, mottled loam about 7 inches thick. The subsoil is firm, mottled silt loam about 24 inches thick. The upper part is olive, and the lower part is gray and dark gray. The substratum to a depth of about 60 inches is dark grayish brown, mottled, firm, calcareous shaly silt loam.

Included with this soil in mapping are small areas of Locke, Barry, and Teasdale soils. Barry soils are poorly drained and are in depressions. The loamy Locke and Teasdale soils are more droughty during the summer than the Hatmaker soil. They are along the edges of the mapped areas. Included soils make up 2 to 7 percent of the unit.

Permeability is moderately rapid in the upper part of the Hatmaker soil and moderately slow in the substratum. Available water capacity is high. Runoff is very slow or slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from late in fall to spring.

Most areas of this soil are used for crops. A few are used for pasture or have a permanent cover of vegetation, including trees (fig. 6).

This soil is well suited to corn, soybeans, winter wheat, and alfalfa. Wetness, water erosion, and tilth are the major management concerns. A combination of surface drains and subsurface tile is effective in removing excess water. Closely spaced subsurface tile lines may be needed because of the moderately slow permeability in the substratum. Suitable filtering material is needed to keep silt from flowing into the tile lines. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. A crop rotation that includes close-growing crops, such as hay and small grain, helps to control water erosion. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface also helps to control water erosion. Returning crop residue to the soil and growing green manure crops help to maintain good tilth.

This soil is well suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The equipment limitation and the windthrow hazard are the management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

This soil is poorly suited to building site development and is generally unsuited to septic tank absorption fields because of the wetness. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table.

The land capability classification is IIw. The Michigan soil management group is 2.5b.

8—Cohoctah sandy loam. This is a level, very poorly drained soil on flood plains along rivers and streams. It is frequently flooded. Areas are long and narrow and range from 3 to 400 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 11 inches thick. The upper part of the substratum is dark gray and dark grayish brown, mottled, firm sandy loam. The next part is dark gray, very friable gravelly sandy loam. The lower part to a depth of about

Figure 6.—An idle area of Hatmaker loam, 1 to 4 percent slopes, in the foreground.

60 inches is dark gray, loose very gravelly sand. In some areas the substratum has finer textured layers.

Included with this soil in mapping are small areas of Adrian and Sebewa soils. Adrian soils have 16 to 50 inches of muck. Sebewa soils are on the slightly higher parts of the landscape and are not subject to flooding. Both of the included soils are in scattered areas throughout the unit. They make up 3 to 12 percent of the unit.

Permeability is moderately rapid in the upper part of the Cohoctah soil and very rapid in the lower part. Available water capacity is moderate. Runoff is very slow or ponded. The seasonal high water table is at or near the surface from early in fall to late in spring.

Most areas support native vegetation, including trees. Because of the frequent flooding, this soil is generally unsuited to cultivated crops. It is poorly suited to pasture. Wetness, overgrazing, and flooding are the major management concerns. A surface drainage system can reduce the wetness but is not feasible in all areas. Seeding reed canarygrass and other pasture plants that can withstand the flooding and the wetness helps to maintain the vegetative cover.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding and furrowing, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

This soil is generally unsuitable for building site development and septic tank absorption fields because of the wetness and the flooding.

The land capability classification is Vw. The Michigan soil management group is L-2c.

9A—Matherton sandy loam, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on broad flats, low knolls, and ridges. Areas are irregular in shape and range from 3 to 440 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsoil is about 18 inches thick. It is brown, mottled, and friable. The upper part is clay loam, and the lower part is gravelly clay loam. The substratum to a depth of about 60 inches is light yellowish brown, loose gravelly sand. In some areas gravelly sand or sand is at a depth of less than 24 inches or more than 40 inches.

Included with this soil in mapping are small areas of Branch and Sebewa soils. Branch soils are moderately well drained and are on the higher knolls. They are coarser textured than the Matherton soil. Sebewa soils are poorly drained and are in depressions and narrow drainageways. Included soils make up 2 to 9 percent of the unit.

Permeability is moderate in the upper part of the Matherton soil and rapid or very rapid in the lower part. Available water capacity is low. Runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from fall to late in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

If drained, this soil is well suited to corn, soybeans, and winter wheat. Wetness, soil blowing, and the organic matter content are the major management concerns. Also, measures that conserve moisture are needed during the summer. A combination of surface drains and subsurface tile is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface helps to control soil blowing and conserves moisture. Buffer strips and field windbreaks reduce the susceptibility to soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content.

This soil is well suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The equipment limitation and the windthrow hazard are the main management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

Because of the wetness, this soil is poorly suited to building site development. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table. Because of the wetness and a poor filtering capacity, the soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Special construction methods, such as mounding with suitable material, may be needed to raise the absorption field above the seasonal high water table.

The land capability classification is IIw. The Michigan soil management group is 3/5b.

10A—Brady sandy loam, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on broad flats and low knolls. Areas are irregular in shape and range from 3 to 220 acres in size.

Typically, the surface layer is dark brown sandy loam about 9 inches thick. The subsoil is about 51 inches thick. The upper part is brown and dark yellowish brown, mottled, friable sandy loam; the next part is brown, mottled, friable loamy sand; and the lower part is dark grayish brown, loose loamy sand. The substratum to a depth of about 70 inches is light brownish gray, loose, calcareous gravelly sand. In some areas calcareous gravelly sand or sand is at a depth of less than 40 inches.

Included with this soil in mapping are small areas of Bronson and Gilford soils. Bronson soils are moderately well drained and are on isolated knolls. Gilford soils are very poorly drained and are in depressions and narrow drainageways. Included soils make up 4 to 9 percent of the unit.

Permeability is moderately rapid in the Brady soil. Available water capacity is low. Runoff is very slow. The seasonal high water table is at a depth of 1 to 3 feet from fall to late in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is well suited to corn, soybeans, winter wheat, and alfalfa. Wetness is a limitation during some periods, and droughtiness is a limitation during other periods. Soil blowing and the organic matter content are additional management concerns. A combination of surface drains and subsurface tile is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface helps to control soil blowing and conserves moisture. Buffer strips and field windbreaks reduce the susceptibility to soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter.

This soil is well suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The equipment limitation and the windthrow hazard are the main

management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

Because of the wetness, this soil is poorly suited to building site development and septic tank absorption fields. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the seasonal high water table.

The land capability classification is IIw. The Michigan soil management group is 3b.

11B—Elmdale fine sandy loam, 2 to 6 percent slopes. This is an undulating, moderately well drained soil on foot slopes, side slopes, and low ridges. Areas are irregular in shape and range from 3 to 750 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 45 inches thick. It is dark yellowish brown and friable. The upper part is loamy fine sand, the next part is fine sandy loam, and the lower part is mottled fine sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, friable, calcareous fine sandy loam. In some areas calcareous fine sandy loam is at a depth of less than 40 inches.

Included with this soil in mapping are small areas of Hillsdale, Locke, and Teasdale soils. Hillsdale soils are well drained and are on the slightly higher knolls and ridges. Locke and Teasdale soils are somewhat poorly drained and are on foot slopes and in the lower positions on side slopes. Included soils make up 2 to 15 percent of the unit.

Permeability and available water capacity are moderate in the Elmdale soil. Runoff is slow. The seasonal high water table is at a depth of 2 to 3 feet from fall to spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion, soil blowing, and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, helps to control water erosion. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface helps to control erosion and soil blowing. Buffer strips and field windbreaks reduce the susceptibility to soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration.

This soil is well suited to pasture. Overgrazing during long dry periods is the major management concern. Grazing should be deferred during these periods. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the wetness, this soil is only fairly well suited to building site development and is poorly suited to septic tank absorption fields. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the water table.

The land capability classification is IIe. The Michigan soil management group is 3a.

12A—Teasdale fine sandy loam, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on broad flats and low knolls. Areas are irregular in shape and range from 2 to 460 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The next layer is mixed light yellowish brown and yellowish brown, mottled fine sandy loam about 9 inches thick. The subsoil is firm fine sandy loam about 39 inches thick. The upper part is dark yellowish brown and yellowish brown and is mottled, and the lower part is mixed yellowish brown, dark yellowish brown, and brown. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous fine sandy loam. In some areas calcareous loamy material is at a depth of less than 40 inches.

Included with this soil in mapping are small areas of Barry and Elmdale soils. Barry soils are poorly drained and are in depressions and narrow drainageways. Elmdale soils are moderately well drained and are higher on the landscape than the Teasdale soil. Included soils make up 11 to 15 percent of the unit.

Permeability and available water capacity are moderate in the Teasdale soil. Runoff is very slow or slow. The seasonal high water table is at a depth of 1 to 2 feet from fall to late in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

If drained, this soil is well suited to corn, soybeans, winter wheat, and tomatoes. Wetness, soil blowing, and the organic matter content are the major management concerns. A combination of surface drains and subsurface tile is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. A system

of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface helps to control soil blowing. Buffer strips and windbreaks also help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter.

This soil is well suited to pasture. Wetness, overgrazing, and soil compaction are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The equipment limitation and the windthrow hazard are the main management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

Because of the wetness, this soil is poorly suited to building site development and septic tank absorption fields. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the water table.

The land capability classification is IIw. The Michigan soil management group is 3b.

14—Houghton muck. This is a level or slightly depressional, very poorly drained, organic soil in swamps, along waterways, and in depressions. It is frequently ponded. Areas are irregular in shape and range from 3 to 420 acres in size.

Typically, the surface layer is black muck about 9 inches thick. Below this to a depth of about 60 inches is very dark brown and black muck. In some areas a mineral or marl layer is at a depth of less than 51 inches. In other areas the soil has layers containing woody fibers.

Permeability is moderately slow to moderately rapid. Available water capacity is high. Runoff is very slow or ponded. This soil has a seasonal high water table near or above the surface from early in fall to late in spring.

Most areas of this soil support native vegetation, including trees. A few are used for unimproved pasture or for crops.

This soil is generally unsuitable as cropland. Adequate drainage outlets are not available in most areas. In a few large areas, however, they are available. If these areas are drained, the soil is fairly well suited to row crops, such as corn and soybeans, and to specialty crops, such as potatoes, carrots, onions, and mint. Wetness and soil blowing are the major management concerns. Deep ditches and tile effectively remove excess water. Field windbreaks, buffer strips, and winter cover crops help to control soil blowing.

This soil is poorly suited to pasture. The wetness is the major management concern. Seeding water-tolerant plants, such as reed canarygrass, helps to maintain the vegetative cover.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is frozen. Special site preparation, such as bedding, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for building site development and septic tank absorption fields.

The land capability classification is Vw. The Michigan soil management group is Mc.

15B—Locke fine sandy loam, 1 to 4 percent slopes. This is a nearly level and undulating, somewhat poorly drained soil on broad flats, low knolls, and low ridges. Areas are irregular in shape and range from 3 to 1,200 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is about 22 inches thick. It is mottled and friable. The upper part is dark yellowish brown sandy clay loam, and the lower part is yellowish brown loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, calcareous sandy loam. In some areas the depth to calcareous sandy loam is more than 40 inches.

Included with this soil in mapping are small areas of Barry, Hatmaker, Hillsdale, and Riddles soils. Barry soils are poorly drained and are in depressions and narrow drainageways. Hatmaker soils are underlain by unconsolidated shale bedrock. They are in scattered areas throughout the unit. Hillsdale and Riddles soils are well drained and are higher on the landscape than the Locke soil. Included soils make up 10 to 15 percent of the unit.

Permeability and available water capacity are moderate in the Locke soil. Runoff is very slow or slow. The seasonal high water table is at a depth of 1 to 2 feet from fall to late in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

If drained, this soil is well suited to corn, soybeans, tomatoes, winter wheat, and alfalfa. Water erosion, soil blowing, excess water, and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small

grain, helps to control water erosion. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface helps to prevent excessive erosion and soil blowing. Buffer strips and field windbreaks reduce the susceptibility to soil blowing. A combination of surface drains and subsurface tile is effective in removing excess water. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. Returning crop residue to the soil and growing green manure crops increase the content of organic matter (fig. 8).

This soil is well suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The equipment limitation and the windthrow hazard are the main management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

Because of the wetness, this soil is poorly suited to building site development and septic tank absorption fields. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the water table. The included Hillsdale and Riddles soils are better suited to septic tank absorption fields and building site development because they are well drained.

The land capability classification is IIe. The Michigan soil management group is 3b.

17—Barry loam. This is a level, poorly drained soil on broad flats and in drainageways. It is frequently ponded. Areas are irregular in shape and range from 3 to 700 acres in size.

Typically, the surface layer is very dark gray loam about 12 inches thick. The subsoil is about 26 inches thick. It is mottled. The upper part is dark grayish brown, firm clay loam; the next part is gray, firm loam; and the lower part is light brownish gray, friable loam. The substratum to a depth of about 60 inches is light brownish gray, yellowish brown, and brownish yellow, firm, calcareous sandy loam. In some areas the surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of Locke and Teasdale soils. These soils are somewhat poorly drained and are higher on the landscape than the Barry soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Barry soil. Available water capacity is high. Runoff is slow. The seasonal high water table is near or above the surface from fall to late in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

If drained, this soil is well suited to corn, soybeans, and tomatoes. Wetness and tilth are the major management concerns. A combination of surface drains and subsurface tile is effective in removing excess water if adequate outlets are available. Erosion-control structures may be needed at the outlet of surface ditches and natural drainageways. The soil tends to puddle and crust after heavy rains. Tillage during periods when moisture levels are high can result in cloddiness and compaction and can alter soil structure. Applying a system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is fairly well suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during excessively wet periods minimize damage to pasture plants and deterioration of tilth. A suitable legume-grass seeding mixture, such as one that includes birdsfoot trefoil, smooth bromegrass, and timothy, results in a long-lived stand that has a long grazing season.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for building site development and septic tank absorption fields.

The land capability classification is IIw. The Michigan soil management group is 3c.

18B—Spinks loamy fine sand, 0 to 6 percent slopes. This is a nearly level and gently sloping, well drained soil on low knolls and ridges. Areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 11 inches thick. The subsurface layer is yellowish brown loamy fine sand about 9 inches thick. The next 32 inches is light yellowish brown, loose fine sand that has bands of strong brown, friable loamy fine sand. The substratum to a depth of about 60 inches is

yellowish brown, loose sand. In some areas the bands of loamy fine sand total less than 6 inches thick.

Included with this soil in mapping are small areas of Ormas, Oshtemo, and Thetford soils. Ormas and Oshtemo soils are less droughty than the Spinks soil. They are in scattered areas throughout the unit. Thetford soils are somewhat poorly drained and are lower on the landscape than the Spinks soil. Included soils make up 7 to 13 percent of the unit.

Permeability is moderately rapid in the Spinks soil. Available water capacity is low. Runoff is very slow to medium.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn, soybeans, and winter wheat and is well suited to gladiolus (fig. 7). Droughtiness, soil blowing, and the organic matter content are the major management concerns. Returning crop residue to the soil and growing green manure crops increase the content of organic matter. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface conserves moisture and helps to control soil blowing. Applying tillage methods that leave the surface rough, ridging at an angle to the prevailing wind, and establishing buffer strips and field windbreaks also help to control soil blowing.

This soil is fairly well suited to pasture. Droughtiness and overgrazing are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The seedling mortality rate is the main management concern. It can be reduced by intensive site preparation before the seedlings are planted.

This soil is well suited to building site development and septic tank absorption fields. No major hazards or limitations affect these uses.

Figure 7.—Gladiolus on Spinks loamy fine sand, 0 to 6 percent slopes. Because of the sandy surface layer, this soil is well suited to gladiolus.

The land capability classification is IIIs. The Michigan soil management group is 4a.

19—Barry loam, shaly substratum. This is a level, poorly drained soil in depressional areas and drainageways. It is frequently ponded. Areas are irregular in shape and range from 3 to 110 acres in size.

Typically, the surface layer is very dark gray loam about 12 inches thick. The subsoil is about 26 inches thick. It is mottled. The upper part is dark grayish brown, firm clay loam; the next part is gray, firm loam; and the lower part is light brownish gray, friable loam. The substratum to a depth of about 60 inches is gray shaly loam. In some areas the surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of Hatmaker soils. These soils are somewhat poorly drained and are on low knolls. They make up 2 to 5 percent of the unit.

Permeability is moderate in the upper part of the Barry soil and moderately slow in the substratum. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface from fall to late in spring.

Most areas of this soil have a permanent cover of vegetation, including trees. A few areas are used for crops or pasture.

If drained, this soil is well suited to corn, soybeans, and winter wheat. Wetness and tilth are the major management concerns. A combination of surface drains and subsurface tile is effective in removing excess water, but adequate outlets may not be available. Closely spaced subsurface tile lines may be needed because of the moderately slow permeability in the substratum. Suitable filtering material is needed to keep silt from flowing into the tile lines. The soil tends to puddle and crust after heavy rains. Tillage during periods when moisture levels are high can result in cloddiness and compaction and can alter soil structure. Applying a system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is fairly well suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Deferment of grazing during wet periods minimizes damage to pasture plants and deterioration of tilth. A suitable legume-grass seeding mixture, such as one that includes birdsfoot trefoil, smooth bromegrass, and timothy, results in a long-lived stand that has a long grazing season.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for building site development and septic tank absorption fields.

The land capability classification is IIw. The Michigan soil management group is 2.5c.

20—Adrian muck. This is a level or slightly depressional, very poorly drained organic soil in swamps, along waterways, and in depressions. It is subject to frequent ponding. The areas are irregular in shape and range from 3 to 210 acres in size.

Typically, the surface layer is black muck about 8 inches thick. The subsoil is friable muck about 23 inches thick. The upper part is black, and the lower part is very dark brown. The substratum to a depth of about 60 inches is dark gray, loose loamy sand. In places a loamy or clayey layer is in the substratum. In some areas the organic material is less than 16 inches thick, and in others it is more than 50 inches thick.

Included with this soil in mapping are small areas of Gilford soils. These soils do not have organic layers and are along the edges of the mapped areas. They make up 2 to 7 percent of the unit.

Permeability is moderately slow to moderately rapid in the upper part of the Adrian soil and rapid in the substratum. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface from early in fall to late in spring.

Most areas of this soil support native vegetation, including trees. A few areas are used for unimproved pasture or for crops.

This soil is not suited to cropland. Adequate drainage outlets are not available in most areas. Crops can be grown only in areas where outlets are available. Drained areas can be used for corn, soybeans, or specialty crops, such as potatoes, carrots, onions, and mint. Wetness and soil blowing are the major management concerns. Deep ditches and tile remove excess water. Field windbreaks, buffer strips, and winter cover crops help to control soil blowing.

This soil is poorly suited to pasture. The wetness is the major management concern. Seeding water-tolerant plants, such as red canarygrass, helps to maintain the vegetative cover.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is frozen. Special site preparation, such as bedding, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for building site development and septic tank absorption fields.

The land capability classification is Vw. The Michigan soil management group is M/4c.

21A—Bronson sandy loam, 0 to 3 percent slopes. This is a nearly level, moderately well drained soil on broad flats, low knolls, and low ridges. Areas are irregular in shape and range from 3 to 370 acres in size.

Typically, the surface layer is brown sandy loam about 13 inches thick. The subsoil is about 39 inches thick. It is friable. The upper part is dark yellowish brown sandy loam; the next part is yellowish brown, mottled sandy loam; and the lower part is light yellowish brown, mottled loamy sand. The substratum to a depth of about 60 inches is brown, loose, calcareous gravelly sand. In some areas the depth to calcareous gravelly sand is less than 40 inches.

Included with this soil in mapping are small areas of Brady, Gilford, and Oshtemo soils. Brady soils are somewhat poorly drained and are lower on the landscape than the Bronson soil. Gilford soils are very poorly drained and are in depressions and narrow drainageways. Oshtemo soils are well drained and are higher on the landscape than the Bronson soil. Included soils make up 7 to 15 percent of the unit.

Permeability is moderately rapid. Available water capacity is moderate. Runoff is slow. The seasonal high water table is at a depth of 2.0 to 3.5 feet from late in fall to early in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is well suited to corn, soybeans, and winter wheat. Droughtiness, soil blowing, and the organic matter content are the major management concerns. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface conserves moisture and reduces the susceptibility to soil blowing. Buffer strips and field windbreaks help to control soil blowing. Irrigation may be needed when soil moisture levels are low. Seeding the irrigation equipment lanes helps to control erosion.

This soil is fairly well suited to pasture. Droughtiness and overgrazing during excessively dry periods are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during excessively dry periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the wetness, this soil is only fairly well suited to building site development and septic tank absorption fields. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the seasonal high water table.

The land capability classification is IIs. The Michigan soil management group is 3a.

22—Palms muck. This is a level or slightly depressional, very poorly drained, organic soil in swamps, along drainageways, and in depressions. It is frequently ponded. Areas are irregular in shape and range from 3 to 45 acres in size.

Typically, the surface layer is black muck about 8 inches thick. The subsoil is friable muck about 23 inches thick. It is black in the upper part and very dark brown in the lower part. The substratum to a depth of about 60 inches is dark grayish brown, friable, calcareous clay loam. In some areas the organic material is less than 16 inches thick, and in others it is more than 50 inches thick.

Included with this soil in mapping are small areas of Barry soils. These soils do not have organic layers. They are along the edges of the mapped areas. They make up 2 to 8 percent of the unit.

Permeability is moderately slow to moderately rapid in the upper part of the Palms soil and moderate or moderately slow in the lower part. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface from early in fall to late in spring.

Most areas of this soil support native vegetation, including trees. A few areas are used for unimproved pasture or for crops.

Unless drained, this soil is poorly suited to cropland. Adequate drainage outlets are not available in most areas. Crops can be grown only in areas where outlets are available. If drained, the soil is fairly well suited to row crops, such as corn and soybeans, and to specialty crops, such as potatoes, carrots, onions, and mint. Wetness and soil blowing are the major management concerns. Deep ditches and tile effectively remove excess water. Field windbreaks, buffer strips, and winter cover crops help to control soil blowing.

This soil is poorly suited to pasture. The wetness is the major management concern. Seeding water-tolerant plants, such as reed canarygrass, helps to maintain the vegetative cover.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is frozen. Special site preparation, such as bedding,

reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for building site development and septic tank absorption fields.

The land capability classification is Vw. The Michigan soil management group is M/3c.

24—Sebewa loam. This is a level, poorly drained soil on broad flats and in drainageways. It is frequently ponded. Areas are irregular in shape and range from 3 to 420 acres in size.

Typically, the surface layer is very dark gray loam about 12 inches thick. The subsoil is mottled loam about 19 inches thick. The upper part is grayish brown and firm, and the lower part is dark gray and friable. The substratum to a depth of about 60 inches is grayish brown, loose, calcareous sand. In some areas the surface layer is less than 10 inches thick. In other areas the depth to calcareous sand is more than 40 inches.

Included with this soil in mapping are small areas of Gilford and Matherton soils. Gilford soils have less clay in the subsoil than the Sebewa soil. They are in scattered areas throughout the unit. Matherton soils are somewhat poorly drained and are higher on the landscape than the Sebewa soil. Included soils make up 4 to 11 percent of the unit.

Permeability is moderate in the upper part of the Sebewa soil and rapid in the lower part. Available water capacity is moderate. Runoff is very slow or ponded. The seasonal high water table is near or above the surface from early in fall to late in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

If drained, this soil is well suited to corn, soybeans, and winter wheat. Wetness and tilth are the major management concerns. Surface drains and subsurface tile are effective in removing excess water, but adequate outlets may not be available. Erosion-control structures may be needed at the outlets of surface ditches and natural drainageways. The soil tends to puddle and crust after heavy rains. Tillage when the moisture level is high can result in cloddiness and compaction and can alter soil structure. Applying a system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is fairly well suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during wet periods help to prevent damage to pasture plants and deterioration of tilth. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red cover, and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for building site development and septic tank absorption fields.

The land capability classification is IIw. The Michigan soil management group is 3/5c.

25B—Branch loamy sand, 1 to 4 percent slopes. This is a nearly level and gently sloping, moderately well drained soil on broad flats, low knolls, and low ridges. Areas are irregular in shape and range from 3 to 240 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is dark yellowish brown and yellowish brown loamy sand and sand about 19 inches thick. The subsoil is mottled, friable sandy loam about 29 inches thick. The upper part is dark yellowish brown, the next part is yellowish brown, and the lower part is dark brown. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous gravelly sand. In some areas, the depth to calcareous gravelly sand is less than 40 inches. In other areas the sandy surface soil is less than 20 inches thick.

Included with this soil in mapping are small areas of Brady, Ormas, and Sebewa soils. Brady soils are somewhat poorly drained and are lower on the landscape than the Branch soil. Ormas soils are well drained and are slightly higher on the landscape than the Branch soil. Sebewa soils are poorly drained and are in depressions and narrow drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Branch soil. Available water capacity is moderate. Runoff is slow. The seasonal high water table is at a depth of 2.0 to 3.5 feet from late in fall to early in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn, soybeans, winter wheat, and alfalfa. Droughtiness, soil blowing, and the organic matter content are the major management concerns. Returning crop residue to the soil and growing green manure crops increase the content of organic matter. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface conserves moisture and helps to control soil blowing. Applying a tillage method that

leaves the surface rough and ridging at an angle to the prevailing wind also help to control soil blowing. Irrigation may be needed when moisture levels are low. Seeding the irrigation equipment lanes helps to control erosion.

This soil is fairly well suited to pasture. Droughtiness and overgrazing are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. A suitable legume-grass mixture, such as one that includes alfalfa and orchardgrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The seedling mortality rate is the main management concern. It can be reduced by intensive site preparation before the seedlings are planted.

Because of the wetness, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields because of the wetness and a poor filtering capacity. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water supplies. Special construction methods, such as filling or mounding with suitable material, may be needed to raise the absorption field above the seasonal high water table.

The land capability classification is IIIs. The Michigan soil management group is 4a.

26—Edwards muck. This is a level or slightly depressional, very poorly drained, organic soil in swamps, along drainageways, and in depressions. It is frequently ponded. Areas are irregular in shape and range from 3 to 600 acres in size.

Typically, the surface layer is black muck about 6 inches thick. Below this is black, friable muck about 18 inches thick. The substratum to a depth of about 60 inches is grayish brown marl. In some areas a mineral layer underlies the muck below a depth of 24 inches. In other areas the organic material is more than 50 inches thick.

Permeability is moderately slow to moderately rapid in the mucky part of the profile. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is near or above the surface from early in fall to late in spring.

Most areas of this soil support native vegetation, including trees. A few areas are used for unimproved pasture or for crops.

This soil is generally unsuitable as cropland. Crops can be grown only in the few areas where adequate drainage outlets are available. If drained, the soil can be used for corn, soybeans, or specialty crops, such as potatoes, carrots, onions, and mint. Wetness and soil blowing are the major management concerns. Deep ditches and tile are needed to remove excess water. Field windbreaks, buffer strips, and winter cover crops help to control soil blowing.

Because of the wetness, this soil is poorly suited to pasture. Seeding water-tolerant plants, such as reed canarygrass, helps to maintain the vegetative cover.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Heavy equipment should be used only when the soil is frozen. Special site preparation, such as bedding, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for building site development and septic tank absorption fields.

The land capability classification is Vw. The Michigan soil management group is M/mc.

27A—Fox sandy loam, 0 to 2 percent slopes. This is a nearly level, well drained soil on broad flats in the uplands. Areas are irregular in shape and range from 3 to 1,080 acres in size.

Typically, the surface layer is brown sandy loam about 11 inches thick. The subsurface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, firm and friable gravelly clay loam, and the lower part is dark yellowish brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose, calcareous very gravelly sand. In some areas the depth to calcareous very gravelly sand is less than 24 or more than 40 inches.

Included with this soil in mapping are small areas of Branch, Matherton, and Oshtemo soils. Branch and Matherton soils are in the lower positions on the landscape. Branch soils are moderately well drained, and Matherton soils are somewhat poorly drained. Oshtemo soils are more droughty than the Fox soil. They are in scattered areas throughout the unit. Included soils make up 2 to 7 percent of the unit.

Permeability is moderate in the upper part of the Fox soil and rapid or very rapid in the lower part. Available water capacity is moderate. Runoff is very slow.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is well suited to corn, soybeans, winter wheat, and alfalfa. Soil blowing, droughtiness, and the organic matter content are the major management concerns. Buffer strips and field windbreaks help to control soil blowing. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface also helps to control soil blowing and conserves moisture. Returning crop residue to the

soil and growing green manure crops increase the content of organic matter. Irrigation may be needed when moisture levels are low.

This soil is well suited to pasture. No major hazards or limitations affect pasture areas. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development. Because of a poor filtering capacity, it is only fairly well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IIs. The Michigan soil management group is 3/5a.

27B—Fox sandy loam, 2 to 6 percent slopes. This is a gently sloping, well drained soil on knolls and low ridges. Areas are irregular in shape and range from 5 to 600 acres in size.

Typically, the surface layer is brown sandy loam about 11 inches thick. The subsurface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, firm and friable gravelly clay loam, and the lower part is dark yellowish brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose, calcareous very gravelly sand. In some areas the depth to calcareous gravelly sand is less than 24 or more than 40 inches.

Included with this soil in mapping are small areas of Branch, Matherton, and Oshtemo soils. Branch and Matherton soils are lower on the landscape than the Fox soil. Branch soils are moderately well drained, and Matherton soils are somewhat poorly drained. Oshtemo soils are more droughty than the Fox soil. They are in scattered areas throughout the unit. Included soils make up 3 to 11 percent of the unit.

Permeability is moderate in the upper part of the Fox soil and rapid or very rapid in the lower part. Available water capacity is moderate. Runoff is very slow to medium.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion, soil blowing, droughtiness, and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, reduces the susceptibility to water erosion. Cover crops and a system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface help to control erosion and soil blowing and conserve moisture. Buffer strips and field windbreaks help to prevent excessive soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration. Irrigation may be needed when moisture levels are low. Seeding the irrigation equipment lanes helps to control erosion.

This soil is well suited to pasture. No major hazards or limitations affect pastured areas. A suitable legume-grass mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect pastured areas.

This soil is well suited to building site development. Because of a poor filtering capacity, it is only fairly well suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IIe. The Michigan soil management group is 3/5a.

27C—Fox sandy loam, 6 to 12 percent slopes. This is a moderately sloping, well drained soil on knolls and low ridges. Areas are irregular in shape and range from 3 to 640 acres in size.

Typically, the surface layer is brown sandy loam about 11 inches thick. The subsurface layer is dark yellowish brown sandy loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, firm and friable gravelly clay loam, and the lower part is dark yellowish brown, friable gravelly sandy loam. The substratum to a depth of about 60 inches is dark yellowish brown, loose calcareous very gravelly sand. In some areas the depth to calcareous very gravelly sand is less than 24 or more than 40 inches.

Included with this soil in mapping are small areas of Matherton, Oshtemo, and Sebewa soils. Matherton soils are somewhat poorly drained and are lower on the landscape than the Fox soil. Oshtemo soils are more droughty than the Fox soil. They are in scattered areas throughout the unit. Sebewa soils are poorly drained and are in small depressions and narrow drainageways. Included soils make up 4 to 12 percent of the unit.

Permeability is moderate in the upper part of the Fox soil and rapid or very rapid in the lower part. Available water capacity is moderate. Runoff is rapid.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion, soil blowing, the organic matter content, and droughtiness are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, reduces the susceptibility to water erosion. Cover crops

and a system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface help to control erosion and soil blowing and conserve moisture. Buffer strips and field windbreaks help to prevent excessive soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration.

This soil is well suited to pasture. No major hazards or limitations affect pastured areas. A suitable legume-grass mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the slope, this soil is only fairly well suited to building site development. It is only fairly well suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IIIe. The Michigan soil management group is 3/5a.

29B—Morley silt loam, 1 to 6 percent slopes. This is a nearly level and undulating, well drained soil on foot slopes, knolls, and low ridges. It commonly is dissected by shallow drainageways. Areas are irregular in shape and range from 3 to 400 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 18 inches thick. The upper part is brown, friable silt loam, and the lower part is brown and yellowish brown, firm silty clay loam. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In some areas the surface layer is thicker and darker.

Included with this soil in mapping are small areas of silty soils that have a mottled subsoil. These soils are somewhat poorly drained or poorly drained and are lower on the landscape than the Morley soil. They make up 1 to 10 percent of the unit.

Permeability is moderately slow or slow in the Morley soil. Available water capacity is moderate. Runoff is medium or rapid.

Most areas of this soil are used for crops. A few are used as pasture.

This soil is well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, helps to control water erosion. Cover crops, sod waterways, and a system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface also help to control water erosion. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration.

This soil is well suited to pasture. Compaction is the major management concern. It results from grazing when the soil is wet. Restricted use during wet periods, pasture rotation, and proper stocking rates help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the shrink-swell potential, this soil is only fairly well suited to building site development. Widening the foundation trench and then backfilling with suitable coarse textured material help to control shrinking and swelling. The soil is poorly suited to septic tank absorption fields because of the moderately slow or slow permeability. Special construction methods, such as filling or mounding with suitable material, are needed.

The land capability classification is IIe. The Michigan soil management group is 1.5a.

29C—Morley silt loam, 6 to 12 percent slopes. This is a gently rolling, well drained soil on foot slopes, side slopes, and knolls. In some areas it is dissected by shallow drainageways. Areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 18 inches thick. The upper part is brown, friable silt loam, and the lower part is brown and yellowish brown, firm silty clay loam. The substratum to a depth of about 60 inches is brown, firm silty clay loam. In some areas the surface layer is thicker and darker.

Included with this soil in mapping are small areas of silty soils that have a mottled subsoil. These soils are somewhat poorly drained or poorly drained and are lower on the landscape than the Morley soil. They make up 1 to 15 percent of the unit.

Permeability is moderately slow or slow in the Morley soil. Available water capacity is moderate. Runoff is rapid.

Most areas of this soil are used for crops. A few are used as pasture.

This soil is fairly well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion and the organic matter content are the major management concerns. A cropping system that includes close-growing crops, such as hay and small grain, helps to control water erosion. Cover crops, sod waterways, and a system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface also help to control water erosion. Returning crop residue to the soil and

growing green manure crops increase the content of organic matter and the rate of water infiltration.

This soil is well suited to pasture. Compaction is the major management concern. It results from grazing when the soil is wet. Restricted use during wet periods, pasture rotation, and proper stocking rates help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the slope and the shrink-swell potential, this soil is only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Widening the foundation trench and then backfilling with suitable fill material help to overcome the shrink-swell potential. The soil is poorly suited to septic tank absorption fields because of the moderately slow or slow permeability and the slope. Special construction methods, such as backfilling or mounding with suitable material, are needed because of the restricted permeability. Land shaping may be necessary to overcome the slope.

The land capability classification is IIIe. The Michigan soil management group is 1.5a.

30B—Leoni gravelly sandy loam, 0 to 6 percent slopes. This is a nearly level and gently sloping, well drained soil on low knolls and ridges. Areas are irregular in shape and range from 3 to 250 acres in size.

Typically, the surface layer is brown gravelly sandy loam about 9 inches thick. The subsoil is about 29 inches thick. The upper part is dark yellowish brown, friable gravelly sandy loam; the next part is yellowish red, firm very gravelly sandy clay loam; and the lower part is dark reddish brown, friable very gravelly sandy clay loam. The substratum to a depth of about 60 inches is yellowish brown, loose, calcareous very gravelly sand. In some areas the depth to calcareous gravelly sand is less than 30 inches. In other areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of Fox and Ormas soils. These soils have a lower content of pebbles and cobbles than the Leoni soil and are not as droughty. They are in scattered areas throughout the unit. They make up 3 to 10 percent of the unit.

Permeability is moderate in the upper part of the Leoni soil and moderately rapid or rapid in the lower part. Available water capacity is low. Runoff is very slow to medium.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn, soybeans, winter wheat, and alfalfa. The organic matter content, droughtiness, and stoniness are the major management concerns. Applying a system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, returning crop residue to the soil, and growing green manure crops conserve moisture and increase the organic matter content. Removing stones with a rock picker and stockpiling or burying them only slightly reduce the stoniness. Irrigation may be needed when moisture levels are low. Seeding the irrigation equipment lanes helps to control erosion.

This soil is fairly well suited to pasture. Droughtiness and overgrazing during dry periods are the main management concerns. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland, building site development, and septic tank absorption fields. No major hazards or limitations affect these uses.

The land capability classification is IIIs. The Michigan soil management group is Ga.

32A—Thetford loamy fine sand, 0 to 3 percent slopes. This is a nearly level, somewhat poorly drained soil on broad flats. Areas are irregular in shape and range from 3 to 15 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is yellowish brown, mottled loamy fine sand about 6 inches thick. The next 28 inches is light yellowish brown, mottled, loose fine sand that has bands of brown, firm fine sandy loam. The substratum to a depth of about 80 inches is pale brown, mottled, calcareous fine sand. In some areas the bands of fine sandy loam total less than 6 inches thick.

Included with this soil in mapping are small areas of Gilford and Spinks soils. Gilford soils are very poorly drained and are lower on the landscape than the Thetford soil. Spinks soils are well drained and are on ridges and low knolls. Included soils make up 4 to 8 percent of the unit.

Permeability is moderately rapid in the Thetford soil. Available water capacity is low. Runoff is very slow or slow. The seasonal high water table is a depth of 1 to 2 feet from winter to late in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn, soybeans, winter wheat, and alfalfa. Wetness is a limitation during some periods, and droughtiness is a limitation during other periods. Soil blowing and the organic matter content are additional management concerns. A combination of surface drains and subsurface tile is effective in removing excess water if suitable drainage outlets are available. Erosion-control structures may be needed at

the outlets of surface ditches and natural drainageways. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface helps to control soil blowing and conserves moisture. Applying tillage methods that leave the surface rough and ridging at an angle to the prevailing wind help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter.

This soil is fairly well suited to pasture. Wetness and overgrazing are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during excessively wet or dry periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa, red clover, and timothy, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The equipment limitation and the windthrow hazard are the main management concerns. The loose sandy material can interfere with the traction of wheeled equipment, especially during dry periods. Heavy equipment can be used when the soil is frozen. If gravelled, logging roads can be used throughout the year. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Windthrown trees should be periodically removed.

Because of the wetness, this soil is poorly suited to building site development and septic tank absorption fields. A surface or subsurface drainage system helps to lower the water table on sites for buildings. Constructing the buildings on raised, well compacted fill material also helps to overcome the wetness. Filling or mounding with suitable material helps to raise septic tank absorption fields above the seasonal high water table.

The land capability classification is IIIw. The Michigan soil management group is 4b.

33B—Ormas loamy sand, 0 to 6 percent slopes. This is a nearly level and gently sloping, well drained soil on broad flats, low knolls, and ridges. Areas are irregular in shape and range from 3 to 850 acres in size.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsurface layer is yellowish brown, friable loamy sand about 21 inches thick. The subsoil is dark yellowish brown, firm and friable sandy loam about 22 inches thick. The substratum to a depth of about 60 inches is brownish yellow, loose, calcareous gravelly sand. In some areas the depth to calcareous gravelly sand is less than 45 inches.

Included with this soil in mapping are small areas of Fox and Oshtemo soils. These soils do not have a sandy surface layer. They are in scattered areas throughout the unit. They make up 4 to 12 percent of the unit.

Permeability is moderately rapid in the Ormas soil. Available water capacity is moderate. Runoff is slow.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is fairly well suited to corn, soybeans, and winter wheat and is well suited to gladiolus. Soil blowing, droughtiness, and the organic matter content are the major management concerns. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface conserves moisture and helps to control soil blowing. Applying tillage methods that leave the surface rough, ridging at an angle to the prevailing wind, soil blowing, and establishing buffer strips and field windbreaks also help to control soil blowing. Irrigation may be needed when moisture levels are low. Seeding the irrigation equipment lanes helps to control water erosion. Returning crop residue to the soil and growing green manure crops increase the content of organic matter.

This soil is well suited to pasture. Droughtiness and overgrazing during dry periods are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes alfalfa and orchardgrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland. The seedling mortality rate is the main management concern. It can be reduced by intensive site preparation before the seedlings are planted.

This soil is well suited to building site development and septic tank absorption fields. No major hazards or limitations affect these uses.

The land capability classification is IIIs. The Michigan soil management group is 4a.

34B—Owosso sandy loam, 2 to 6 percent slopes. This is an undulating, well drained soil on low knolls and ridges. Areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 10 inches thick. The subsoil is about 40 inches thick. The upper part is brownish yellow, friable sandy loam; the next part is yellowish brown, firm loam; and the lower part is yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, firm, calcareous sandy loam. In some areas 20 to 40 inches of sand or loamy sand overlies the clay loam.

Included with this soil in mapping are small areas of Locke and Teasdale soils. These soils are somewhat poorly drained and are lower on the landscape than the Owosso soil. They make up 4 to 15 percent of the unit.

Permeability is moderate in the Owosso soil. Available water capacity is high. Runoff is very slow to medium.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

This soil is well suited to corn, soybeans, winter wheat, and alfalfa. Water erosion, soil blowing, and the organic matter content are the major management concerns. Cover crops and a system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface help to control water erosion and soil blowing. Buffer strips and field windbreaks also help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the content of organic matter and the rate of water infiltration.

This soil is well suited to pasture. No major hazards or limitations affect pastured areas. A suitable legume-grass seeding mixture, such as one that includes alfalfa and smooth bromegrass, results in a long-lived stand that has a long grazing season.

This soil is well suited to woodland, building site development, and septic tank absorption fields. No major hazards or limitations affect these uses.

The land capability classification is IIe. The Michigan soil management group is 3a.

36—Pits-Aquents complex. This map unit consists of open excavations from which soil and the underlying sand and gravel have been removed and wet, sandy and loamy soils in areas where the landscape has been greatly altered. Many of the pits have been excavated to a depth below the water table. The outer edges of the excavations have steep vertical side slopes. The Aquents occur as exposed soil material at the bottom of the pits and in adjacent areas. They may be bare or may support some vegetation. Areas are square, rectangular, or irregularly shaped and range from 3 to 80 acres in size.

Some of the pits have been a source of clay for use in making brick. Others have been a source of gravel and sand for roads and streets and for concrete. Ponds have been created in some of the pits. Many species of wildlife use the ponds as watering holes. A few pits have small deposits of rubbish and trash. Onsite investigation is needed to determine the suitability of this unit for specific uses.

This map unit is not assigned to interpretive groups.

37—Aquents, sandy and loamy. These nearly level, poorly drained soils are in borrow areas and low areas where the landscape has been greatly altered by filling and leveling. The soils are frequently ponded. Areas are irregular in shape and range from 3 to 180 acres in size.

Included with these soils in mapping are small areas of many different sandy and loamy soils that are undisturbed. These included soils make up as much as 5 percent of the unit.

The soil properties of the Aquents vary greatly. They should be ascertained by onsite investigation. The seasonal high water table is 0.5 foot to 2 feet above the surface from November through May.

Most of the acreage is idle land. Some areas are used for building site development. The suitability of these soils for cultivated crops, woodland, pasture, and building site development varies greatly. Onsite investigation is needed to determine suitability for these uses and the management needed to overcome the major hazards and limitations affecting the uses.

These soils are not assigned to interpretive groups.

38—Udipsamments, gently sloping. These are somewhat poorly drained to well drained soils in borrow areas and low areas where the landscape has been greatly altered by filling and leveling. Areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the profile consists of sandy and gravelly material.

Included with these soils in mapping are small areas of many different sandy soils that are undisturbed. These included soils make up as much as 5 percent of the unit.

The soil properties of the Udipsamments vary greatly. They should be ascertained by onsite investigation. In a few areas the seasonal high water table is near the surface part of the year.

Most of the acreage is idle land or is used for building site development. The suitability of these soils for cultivated crops, woodland, pasture, and building site development varies greatly. Onsite investigation is needed to determine the suitability for these uses and the management needed to overcome the major hazards and limitations affecting the uses.

These soils are not assigned to interpretive groups.

43—Corunna fine sandy loam. This is a level, poorly drained soil on broad flats and in drainageways. It is frequently ponded. Areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is very dark grayish brown, fine sandy loam about 11 inches thick. The subsoil is about 25 inches thick. The upper part is grayish brown, friable fine sandy loam; the next part is grayish brown, mottled, firm fine sandy loam; and the lower part is gray, mottled, friable loam. The substratum to a depth of about 60 inches is gray, mottled clay loam. In some areas the surface layer is less than 10 inches thick. In other areas the surface layer and subsoil are sandy.

Included with this soil in mapping are small areas of Teasdale soils. These soils are somewhat poorly drained and are higher on the landscape than the Corunna soil. They make up 5 to 12 percent of the unit.

Permeability is moderate or moderately rapid in the upper part of the Corunna soil and moderately slow in the lower part. Available water capacity is high. Runoff is

very slow or ponded. The seasonal high water table is near or above the surface from fall to late in spring.

Most areas of this soil are used for crops. A few are used as pasture or have a permanent cover of vegetation, including trees.

If drained, this soil is well suited to corn, soybeans, and winter wheat. Wetness, soil blowing, and tilth are the major management concerns. A combination of surface drains and subsurface tile is effective in removing excess water if suitable outlets are available. Erosion-control structures may be needed at the outlets of surface ditches and natural drainageways. A system of conservation tillage that does not invert the soil and leaves the maximum amount of crop residue on the surface helps to control soil blowing. Buffer strips and field windbreaks also help to control soil blowing. Tillage when moisture levels are high can result in cloddiness and compaction and can alter soil structure. Applying a system of conservation tillage, returning crop residue to the soil, and growing green manure crops improve tilth.

This soil is fairly well suited to pasture. Wetness, overgrazing, and compaction are the major management concerns. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition. A suitable legume-grass seeding mixture, such as one that includes birdsfoot trefoil, smooth bromegrass, and timothy, results in a long-lived stand that has a long grazing season.

This soil is fairly well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced help to prevent windthrow. Windthrown trees should be periodically removed.

Because of the ponding, this soil is generally unsuitable for septic tank absorption fields and building site development.

The land capability classification is IIw. The Michigan soil management group is 3/2c.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wetter, more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table or frequent flooding during the growing season, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

John Barclay, district conservationist, Soil Conservation Service, helped write this section.

General management needed for crops and pasture is suggested in this section. The crops best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1982, about 120,000 acres in Branch County was used for corn. Of this total, about 6,300 acres was harvested for silage. About 21,000 acres was used for wheat, 6,000 acres for oats, and 44,000 acres for soybeans. About 15,000 acres was used for hay (*4*). A number of specialty crops were also grown. The most common of these were apples, gladiolus, peaches, and tomatoes.

Food production in Branch County could be increased by applying soil and water conservation practices and by extending the latest crop production technology to the soils best suited to crops. The major management concerns in the areas used for crops and pasture are water erosion, soil blowing, wetness, droughtiness, fertility, and tilth.

Water erosion is a major hazard on about half of the cropland in Branch County. If slopes are more than 2 percent, water erosion is a hazard, especially in areas where the slopes are more than 400 feet long. Locke fine sandy loam, 1 to 4 percent slopes, is an example of a soil on long slopes.

Loss of the surface layer through erosion reduces the productivity of soils and results in sedimentation in streams and open ditches. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into a plow layer.

Erosion-control practices provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the surface for extended periods reduces the susceptibility to erosion and preserves the productive capacity of the soil. Including forage crops of grasses and legumes in the cropping sequence helps to control erosion on the more sloping land, provides nitrogen for subsequent crops, and improves tilth. Conservation tillage helps to control surface runoff and erosion. The types of conservation tillage used in Branch County include chisel-disc, plow-plant, no-till, and ridge-till. Cover

crops, crop residue, and grassed waterways also help to control erosion.

Soil blowing is a hazard on the sandy Ormas and Spinks soils and on the mucky Adrian, Edwards, Houghton, and Palms soils. Some of the loamy soils also are susceptible to soil blowing. An adequate plant cover, surface mulch, buffer strips, and tillage methods that leave the surface rough help to control soil blowing by leaving crop residue on the surface. Soil blowing also can be controlled by windbreaks.

Soil drainage is a major management concern in about half of the cropland in the county. Drainage of cropland improves the air-water relationship in the root zone. In areas where drainage is poor, spring planting, spraying, and harvesting are delayed and controlling weeds is difficult. Properly designed tile drains, surface drainageways, or both can be used to remove excess water.

Some soils are naturally so wet that they cannot be used for the crops commonly grown in the county. Unless drained, very poorly drained, poorly drained, and somewhat poorly drained soils are so wet that crops are damaged in most years. Examples are Barry, Corunna, Gilford, Hatmaker, Locke, Matherton, and Teasdale soils.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drains and tile drains is needed in most areas of poorly drained and very poorly drained soils that are intensively row cropped. The drains should be more closely spaced in slowly permeable soils than in the more permeable soils. Tile drainage is slow or very slow in Barry and Hatmaker soils. Finding adequate outlets for tile drainage systems is difficult in many areas of Adrian, Barry, Cohoctah, Edwards, Houghton, Palms, and Sebewa soils because of the flat grades. Diversions can be used to remove surface runoff from some wet areas. Good tilth and an ample supply of organic matter also improve drainage. In low lying areas the growing season is shortened by frost late in spring and early in fall.

Organic soils oxidize and subside when their pore space is filled with air. As a result, special systems are needed to control the depth and period of drainage. Maintaining the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of these soils.

Information about the design of drainage systems for each kind of soil is available in local offices of the Soil Conservation Service.

Droughtiness is a limitation on Branch, Fox, Ormas, Oshtemo, and Spinks soils. These soils can be cropped if they are irrigated by sprinklers. Irrigated areas can be used for specialty crops, such as tomatoes and gladiolus. Irrigation is feasible in areas where manmade ponds, surface water, and large diameter wells are suitable sources of water and where the soils have a good intake rate. Conservation tillage, grassed waterways, and good management of irrigation water are needed to control runoff and erosion and improve the efficiency of the irrigation system.

Soil fertility is naturally medium in loamy soils and low in most sandy soils. Many sandy soils naturally are medium acid or slightly acid. Applications of lime or marl are needed to raise the pH level sufficiently for good growth of alfalfa and other crops that grow well only on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields (*5*). The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Some of the soils used for crops have a sandy surface layer that is light in color and low in organic matter content. Generally, the structure of such coils is weak, and intense rainfall causes the surface to crust. This crusting decreases the rate of water infiltration and increases the runoff rate. Regular additions of crop residue, manure, and other organic material improve tilth and help to prevent surface crusting.

Maintaining tilth in the loamy Barry, Sebewa, and Locke soils is difficult. These soils stay wet until late in spring. If plowed when wet, they tend to be compacted and very cloddy when dry. As a result, preparing a good seedbed is difficult. Cover crops, green manure crops, crop residue management, conservation tillage, and applications of livestock manure help to maintain or improve the organic matter content and tilth.

Grazing during wet periods results in compaction, which retards the growth of pasture plants. Proper harvesting methods increase plant growth and help to prevent compaction.

The productivity of a *pasture* and its ability to protect the surface of the soil are influenced by the number of livestock that the pasture supports, the length of time that they graze, and the distribution of rainfall. Good pasture management includes stocking rates that maintain the key forage species, pasture rotation, deferred grazing, and strategic location of water supplies for livestock. The key forage species include alfalfa and smooth bromegrass on medium textured, well drained soils; birdsfoot trefoil, bromegrass, and orchardgrass on wet or hilly, erodible soils; and reed canarygrass on undrained mucks.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because

of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*10*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table. Also given at the end of each map unit description is a Michigan soil management group. The soils are assigned to a group according to the need for lime and fertilizer and for artificial drainage and other practices. For soils making up a complex, the management groups are listed in the same order as the series named in the complex (*6*).

Woodland Management and Productivity

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same

general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility

of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or

kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, reed canarygrass, bromegrass, clover, alfalfa, redtop, and orchardgrass.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are lambsquarters, goldenrod, nightshade, ragweed, dandelion, wild carrot, and thistle.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, maple, cherry, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are American cranberrybush, autumn-olive, crabapple, honeysuckle, dogwood, and silver buffaloberry.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine and spruce.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cattails, bulrushes, sedges, reeds, and arrowhead.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, low dikes, potholes, ponds, and level ditches.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, ring-necked pheasant, meadowlark, field sparrow, cottontail, red fox, woodchuck, and hawks.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include opossum, woodcock, thrushes, woodpeckers, tree squirrels, southern flying squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils

may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel are less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines (fig. 8). This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site

Figure 8.—An area of Fox soils, which are underlain by sand and gravel.

features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent

water table, permeability of the aquifer, and quality of the water. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones. The performance of a system is affected by the depth of the root zone.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

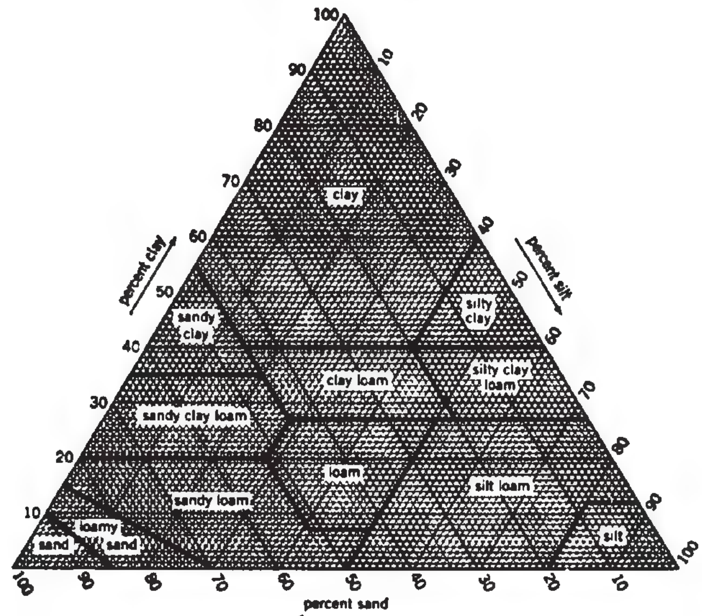


Figure 9.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 9). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of

grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to

buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* means that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 18 shows the expected total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*11*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*9*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*11*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Adrian Series

The Adrian series consists of very poorly drained soils in swamps, along drainageways, and in depressions on till plains, moraines, and outwash plains. These soils formed in deposits of organic material 16 to 50 inches deep over sandy material. Permeability is moderately slow to moderately rapid in the upper part of the pedon and rapid in the lower part. Slope is 0 to 1 percent.

Adrian soils are similar to Edwards, Houghton, and Palms soils and are commonly adjacent to Gilford, Houghton, and Matherton soils. Edwards soils are underlain by marl. Houghton soils are organic

throughout. Palms soils are underlain by loamy material. Gilford soils are slightly higher on the landscape than the Adrian soils and have a loamy solum. Matherton soils are somewhat poorly drained, have a loamy subsoil, and are on side slopes and in nearly level areas. They are higher on the landscape than the Adrian soils.

Typical pedon of Adrian muck, 10 feet north and 860 feet west of the southeast corner of sec. 10, T. 6 S., R. 5 W.

Oa1—0 to 8 inches; black (N 2/0), broken face, and black (10YR 2/1), rubbed, sapric material; about 4 percent fiber, less than 2 percent rubbed; herbaceous fibers; weak fine granular structure; friable; neutral; abrupt wavy boundary.

Oa2—8 to 16 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 6 percent fiber, less than 2 percent rubbed; herbaceous fibers; weak medium subangular blocky structure; friable; neutral; abrupt wavy boundary.

Oa3—16 to 31 inches; very dark brown (10YR 2/2), broken face and rubbed, sapric material; about 10 percent fiber, 3 percent rubbed; herbaceous fibers; moderate coarse subangular blocky structure; friable; slightly acid; gradual wavy boundary.

C—31 to 60 inches; dark gray (10YR 4/1) loamy sand; single grain; loose; neutral.

The depth to the sandy C horizon ranges from 16 to 50 inches. The fibers are primarily herbaceous. In some pedons, however, 50 percent of the organic material is coarse woody fragments of twigs, branches, or logs. The organic material ranges from medium acid to neutral.

The surface tier has hue of 10YR or N and chroma of 0 or 1, broken face and rubbed. The subsurface and bottom tiers have hue of 10YR, 7.5YR, or N, value of 2 or 3, and chroma of 0 to 3, broken face and rubbed. The content of mineral material in the organic horizon immediately above the sandy C horizon is as much as 50 percent. The C horizon has value of 4 or 5 and chroma of 1 or 2. It is dominantly loamy sand, but the range includes sand, gravelly sand, and gravelly loamy sand. This horizon ranges from slightly acid to moderately alkaline.

Barry Series

The Barry series consists of poorly drained soils in depressional areas and on broad flats on till plains and moraines. These soils formed in loamy material. The upper part of the profile is moderately permeable. The substratum is moderately rapidly permeable in most areas but is moderately slowly permeable in areas where it is shaly. Slope is 0 to 1 percent.

Barry soils are similar to Sebewa soils and are commonly adjacent to Locke and Teasdale soils. Sebewa soils are underlain by sand. Locke and Teasdale soils are somewhat poorly drained and have a surface layer that is thinner than that of the Barry soils. Also, they are higher on the landscape.

Typical pedon of Barry loam, 180 feet west and 20 feet north of the southeast corner of sec. 8, T. 5 S., R. 7 W.

Ap—0 to 12 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

Btg1—12 to 18 inches; dark grayish brown (10YR 4/2) clay loam; common fine distinct brown (10YR 4/3) and yellowish brown (10YR 5/4) mottles; moderate medium angular blocky structure; firm; common distinct clay films; neutral; clear smooth boundary.

Btg2—18 to 26 inches; gray (10YR 5/1) loam; common medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium and coarse subangular blocky structure; firm; neutral; gradual wavy boundary.

BCg—26 to 38 inches; light brownish gray (10YR 6/2) loam; many coarse distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; neutral; gradual wavy boundary.

Cg—38 to 60 inches; mixed light brownish gray (10YR 6/2), yellowish brown (10YR 5/4), and brownish yellow (10YR 6/6) sandy loam; massive; firm; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches and corresponds with the depth to free carbonates. The content of pebbles in the solum ranges from 3 to 12 percent. Reaction ranges from slightly acid to mildly alkaline in the solum and is mildly alkaline or moderately alkaline in the C horizon.

The A horizon is generally 10 to 15 inches thick. It has value of 2 or 3 and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam and fine sandy loam. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sandy loam, sandy clay loam, clay loam, or loam. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 4. It is commonly sandy loam, but in some pedons it is fine sandy loam or loamy sand or has thin strata of sand. The shaly substratum phase has a 2C horizon of shaly loam.

Brady Series

The Brady series consists of somewhat poorly drained, moderately rapidly permeable soils on outwash plains. These soils formed in sandy and loamy material. Slope is 0 to 2 percent.

These soils have a lighter colored surface layer and a dominantly grayer subsoil than is definitive for the Brady series. These differences, however, do not significantly affect the usefulness or behavior of the soils.

Brady soils are similar to Bronson soils and are commonly adjacent to Bronson and Gilford soils. Bronson soils are moderately well drained. Gilford soils are very poorly drained and are lower on the landscape than the Brady soils.

Typical pedon of Brady sandy loam, 0 to 2 percent slopes, 2,640 feet east and 670 feet north of the southwest corner of sec. 18, T. 7 S., R. 8 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

Bt1—9 to 20 inches; brown (10YR 5/3) sandy loam; common medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 4/6) mottles; moderate medium subangular blocky structure; friable; common distinct gray (10YR 5/1) clay films; slightly acid; clear smooth boundary.

Bt2—20 to 29 inches; dark yellowish brown (10YR 4/4) sandy loam; many coarse distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 4/6) mottles; weak fine and medium subangular blocky structure; friable; few distinct gray (10YR 5/1) clay films; strongly acid; gradual wavy boundary.

Bt3—29 to 44 inches; brown (10YR 4/3) loamy sand; few medium distinct light gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few faint gray (10YR 5/1) clay films; strongly acid; gradual wavy boundary.

BCg—44 to 60 inches; dark grayish brown (10YR 4/2) loamy sand; single grain; loose; medium acid; gradual wavy boundary.

2Cg—60 to 70 inches; light brownish gray (10YR 6/2) gravelly sand; single grain; loose; about 15 percent pebbles; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 70 inches and corresponds with the depth to free carbonates. The content of pebbles ranges from 1 to 20 percent in the solum and from 10 to 55 percent in the 2C horizon. Reaction ranges from strongly acid to neutral in the solum.

The Ap horizon has chroma of 2 or 3. When dry, it has value of 6 or more. The A horizon is dominantly sandy loam, but the range includes loamy sand. Some pedons have an E horizon. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is loamy sand, sandy loam, sandy clay loam, or gravelly sandy loam. The 2C horizon has value of 5 or 6 and chroma of 1 to 4. It is gravelly sand or sand.

Branch Series

The Branch series consists of moderately well drained, moderately rapidly permeable soils on outwash plains. These soils formed in sandy and loamy material. Slope ranges from 1 to 4 percent.

Branch soils are similar to Ormas soils and are commonly adjacent to Fox, Matherton, and Ormas soils. Ormas soils are well drained. Fox soils have a loamy surface layer, are well drained, and are higher on the landscape than the Branch soils. Matherton soils have a loamy surface layer, are somewhat poorly drained, and are lower on the landscape than the Branch soils.

Typical pedon of Branch loamy sand, 1 to 4 percent slopes, 1,900 feet east and 1,580 feet north of the southwest corner of sec. 28, T. 7 S., R. 8 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

E1—9 to 15 inches; dark yellowish brown (10YR 4/6) loamy sand; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

E2—15 to 28 inches; yellowish brown (10YR 5/6) sand; weak fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bt1—28 to 37 inches; dark yellowish brown (10YR 4/6) sandy loam; few fine faint light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common distinct dark yellowish brown (10YR 4/4) clay films; slightly acid; gradual wavy boundary.

Bt2—37 to 49 inches; yellowish brown (10YR 5/4) sandy loam; common medium distinct light brownish gray (10YR 6/2) and many medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; common distinct yellowish brown (10YR 5/6) clay films; slightly acid; gradual wavy boundary.

Bt3—49 to 57 inches; dark brown (10YR 4/3) sandy loam; many medium distinct grayish brown (10YR 5/2) and dark gray (10YR 4/1) and many medium prominent yellowish brown (10YR 5/8) mottles; moderate medium and coarse angular blocky structure; friable; slightly acid; gradual wavy boundary.

2C—57 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 30 percent pebbles; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 80 inches and corresponds with the depth to free carbonates. The content of pebbles in the Bt and 2C horizons ranges from 10 to 30 percent.

The A horizon has value of 3 to 5 and chroma of 3 to 6. It is dominantly loamy sand, but the range includes loamy fine sand, fine sand, and sand. This horizon ranges from medium acid to neutral. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. It is sandy loam, fine sandy loam, sandy clay loam,

or the gravelly analogs of these textures. It ranges from neutral to strongly acid. The 2C horizon has value of 5 or 6 and chroma of 2 to 4.

Bronson Series

The Bronson series consists of moderately well drained, moderately rapidly permeable soils on outwash plains and moraines. These soils formed in sandy and loamy material. Slope ranges from 0 to 3 percent.

These soils do not have the mottles with low chroma in the upper part of the argillic that are definitive for the Bronson series. This difference, however, does not significantly affect the usefulness or behavior of the soils.

Bronson soils are similar to Brady soils and are commonly adjacent to Brady and Oshtemo soils. Brady soils are somewhat poorly drained. Oshtemo soils are well drained and are higher on the landscape than the Bronson soils.

Typical pedon of Bronson sandy loam, 0 to 3 percent slopes, 1,080 feet south and 1,940 feet east of the northwest corner of sec. 12, T. 7 S., R. 8 W.

Ap—0 to 13 inches; brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; medium acid; abrupt smooth boundary.

Bt1—13 to 19 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common faint dark yellowish brown (10YR 3/6) clay films; strongly acid; clear smooth boundary.

Bt2—19 to 28 inches; dark yellowish brown (10YR 4/4) sandy loam; weak to moderate coarse subangular blocky structure parting to moderate medium subangular blocky; friable; common distinct dark yellowish brown (10YR 3/6) clay films; medium acid; clear smooth boundary.

Bt3—28 to 34 inches; yellowish brown (10YR 5/4) sandy loam; common medium distinct yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8) and common fine faint light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; medium acid; gradual wavy boundary.

BC—34 to 52 inches; light yellowish brown (10YR 6/4) loamy sand; common medium distinct brownish yellow (10YR 6/6) and common fine faint light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; friable; few discontinuous lenses of sandy clay loam; slightly acid; gradual wavy boundary.

2C—52 to 60 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 20 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 70 inches and corresponds with the depth to free carbonates. The content of pebbles ranges from 3 to 25 percent in the solum and from 10 to 55 percent in the 2C horizon. Reaction ranges from medium acid to neutral in the solum and from neutral to moderately alkaline in the 2C horizon.

The A horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly sandy loam, but the range includes loamy sand and fine sandy loam. Some pedons have an E or BA horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4. It is fine sandy loam, loamy fine sand, sandy loam, sandy clay loam, or the gravelly analogs of these textures. The 2C horizon has value of 5 or 6 and chroma of 2 or 3. It is gravelly sand or sand.

Cohoctah Series

The Cohoctah series consists of very poorly drained soils on flood plains. These soils formed in loamy and sandy alluvial material. Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slope is 0 to 1 percent.

Cohoctah soils are similar to Gilford soils and are commonly adjacent to Fox and Branch soils. The content of organic carbon in Gilford soils does not irregularly decrease with increasing depth. The moderately well drained Branch and well drained Fox soils are higher on the landscape than the Cohoctah soils.

Typical pedon of Cohoctah sandy loam, 200 feet east and 25 feet south of the northwest corner of sec. 2, T. 6 S., R. 5 W.

A—0 to 11 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; firm; mildly alkaline; clear wavy boundary.

Cg1—11 to 18 inches; mixed dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) sandy loam; many medium distinct brown (10YR 5/3) mottles; moderate medium angular blocky structure; firm; mildly alkaline; clear wavy boundary.

Cg2—18 to 30 inches; dark gray (10YR 4/1) sandy loam; many coarse distinct dark yellowish brown (10YR 4/4), gray (10YR 5/1), and yellowish brown (10YR 5/8) mottles; massive; firm; neutral; clear wavy boundary.

Cg3—30 to 37 inches; dark gray (10YR 4/1) gravelly sandy loam; weak very fine subangular blocky structure; very friable; about 25 percent pebbles; mildly alkaline; clear wavy boundary.

2Cg4—37 to 60 inches; dark gray (10YR 4/1) very gravelly sand; single grain; loose; about 50 percent pebbles; violent effervescence; moderately alkaline.

Reaction ranges from slightly acid to moderately alkaline throughout the pedon. The content of pebbles

ranges from 0 to 10 percent in the upper part of the pedon and from 20 to 55 percent in the lower part.

The A horizon is generally 10 to 15 inches thick. It has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam, but the range includes loam, silt loam, fine sandy loam, loamy fine sand, and loamy sand. The Cg horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 to 3. In some pedons it has thin layers of organic matter in the upper 30 inches. It is sandy loam, gravelly sandy loam, fine sandy loam, loamy fine sand, or loam. Sandy loam is below a depth of 40 inches in some pedons. The 2Cg horizon has value of 3 to 6 and chroma of 1 or 2. It is very gravelly sand, sand, or stratified sand and gravel.

Corunna Series

The Corunna series consists of poorly drained soils in depressions on till plains and moraines. These soils formed in loamy material. Permeability is moderate or moderately rapid in the upper part of the pedon and moderately slow in the lower part. Slope is 0 to 1 percent.

Corunna soils are similar to Gilford soils and are commonly adjacent to Locke and Teasdale soils. Gilford soils are underlain by sandy material. Locke and Teasdale soils are somewhat poorly drained and are higher on the landscape than the Corunna soils.

Typical pedon of Corunna fine sandy loam, 400 feet west and 660 feet north of the center of sec. 26, T. 6 S., R. 5 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

Bg1—11 to 20 inches; grayish brown (2.5Y 5/2) fine sandy loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.

Bg2—20 to 28 inches; grayish brown (2.5Y 5/2) fine sandy loam; many medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; strong medium angular blocky structure; firm; slightly acid; clear wavy boundary.

Bg3—28 to 36 inches; gray (10YR 5/1) loam; many medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium subangular blocky structure; friable; neutral; gradual wavy boundary.

2Cg1—36 to 46 inches; gray (10YR 6/1) clay loam; many coarse distinct dark yellowish brown (10YR 4/6) and yellow (10YR 7/6) mottles; massive; firm; neutral; gradual wavy boundary.

2Cg2—46 to 60 inches; gray (10YR 6/1) clay loam; many coarse distinct dark yellowish brown (10YR 4/6) and yellow (10YR 7/6) mottles; massive; firm; slight effervescence; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness. It is slightly acid or neutral.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes sandy loam. Some pedons have an A horizon. The Bg horizon has hue of 2.5Y or 10YR, value of 5 or 6, and chroma of 1 to 3. It is fine sandy loam, sandy loam, or loam. The 2Cg horizon has value of 5 or 6 and chroma of 1 or 2. It is clay loam, silty clay loam, or loam.

Edwards Series

The Edwards series consists of very poorly drained soils in swamps, along drainageways, and in depressions on till plains, moraines, and outwash plains. These soils formed in deposits of organic material 16 to 50 inches deep over marl. Permeability is moderately slow to moderately rapid. Slope is 0 to 1 percent.

Edwards soils are similar to Adrian, Houghton, and Palms soils and are commonly adjacent to Gilford, Houghton, and Ormas soils. Adrian soils are underlain by sandy material. Houghton soils are organic throughout. Palms soils are underlain by loamy material. Gilford soils are slightly higher on the landscape than the Edwards soils and have loamy solum. Ormas soils are well drained, have a mineral solum, and are higher on the landscape than the Edwards soils.

Typical pedon of Edwards muck, 160 feet south and 320 feet west of the center of sec. 23, T. 7 S., R. 5 W.

Oa1—0 to 6 inches; black (10YR 2/1), broken face, and very dark brown (10YR 2/2), rubbed, sapric material; about 5 percent fiber, less than 3 percent rubbed; herbaceous fibers; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

Oa2—6 to 19 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 10 percent fiber, less than 5 percent rubbed; herbaceous fibers; moderate medium platy structure; friable; neutral; clear smooth boundary.

Oa3—19 to 24 inches; black (10YR 2/1), broken face and rubbed, sapric material; 15 to 20 percent fiber, 5 percent rubbed; herbaceous fibers; moderate thick platy structure; friable; neutral; clear smooth boundary.

C—24 to 60 inches; grayish brown (10YR 5/2) marl; massive; friable; violent effervescence; moderately alkaline.

The depth to the C horizon ranges from 16 to 50 inches. The fibers are primarily herbaceous. In some pedons, however, as much as 20 percent of the organic material is coarse woody fragments. Some pedons have thin hemic or fibric layers. The organic material ranges from medium acid to mildly alkaline. A layer of coprogenous earth less than 2 inches thick is immediately above the marl in places.

The surface tier has hue of 10YR or N and chroma of 0 to 2, broken face and rubbed. The subsurface and bottom tiers have hue of 10YR, 7.5YR, or N, value of 2 or 3, and chroma of 0 to 2, broken face and rubbed. The marl has value of 5 to 7 and chroma of 1 or 2. In some pedons it has a layer of sandy material less than 12 inches thick within a depth of 51 inches.

Elmdale Series

The Elmdale series consists of moderately well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy material. Slope ranges from 2 to 6 percent.

Elmdale soils are similar to Hillsdale soils and are commonly adjacent to Hillsdale and Teasdale soils. Hillsdale soils are well drained. Teasdale soils are somewhat poorly drained.

Typical pedon of Elmdale fine sandy loam, 2 to 6 percent slopes, 550 feet south and 1,580 feet west of the northeast corner of sec. 34, T. 5 S., R. 8 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; about 3 percent pebbles; slightly acid; abrupt smooth boundary.

BA—9 to 16 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak medium subangular blocky structure; friable; about 3 percent pebbles; slightly acid; few traces of light brownish gray (10YR 6/2) sandy coatings on peds; clear smooth boundary.

Bt1—16 to 27 inches; dark yellowish brown (10YR 4/4) fine sandy loam; moderate medium subangular blocky structure; friable; common faint dark yellowish brown (10YR 3/4) clay films on faces of peds; about 3 percent pebbles; slightly acid; clear wavy boundary.

Bt2—27 to 37 inches; dark yellowish brown (10YR 4/4) fine sandy loam; few fine distinct yellowish brown (l0YR 5/8) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; many distinct dark brown (7.5YR 4/4) clay films on faces of peds; about 3 percent pebbles; medium acid; clear wavy boundary.

Bt3—37 to 54 inches; dark yellowish brown (10YR 4/4) fine sandy loam; few medium distinct yellowish brown (10YR 5/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; about 3 percent pebbles; medium acid; clear wavy boundary.

C—54 to 60 inches; dark yellowish brown (10YR 4/4) fine sandy loam; massive; friable; about 5 percent pebbles; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. Reaction ranges from strongly acid to neutral in most of the solum and from neutral to moderately alkaline in the BC horizon, where it occurs, and in the C horizon. The content of pebbles in the solum and C horizon is as much as 20 percent.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam and loam. The BA horizon has value of 4 to 6 and chroma of 3 or 4. It is loamy fine sand, loamy sand, fine sandy loam, sandy loam, or loam. The Bt horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is dominantly fine sandy loam, sandy loam, or loam. In some pedons, however, it has thin subhorizons of sandy clay loam or clay loam. Some pedons have a BC horizon. The C horizon has value of 4 to 6 and chroma of 3 or 4. It is generally fine sandy loam till but in some pedons has pockets of loamy sand.

Fox Series

The Fox series consists of well drained soils on outwash plains and moraines. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the upper part of the pedon and rapid or very rapid in the lower part. Slope ranges from 0 to 12 percent.

Fox soils are similar to Kidder and Riddles soils and are commonly adjacent to Matherton and Sebewa soils. Kidder and Riddles soils are underlain by loamy material. The somewhat poorly drained Matherton soils and the poorly drained Sebewa soils are lower on the landscape than the Fox soils.

Typical pedon of Fox sandy loam, 2 to 6 percent slopes, 150 feet north and 1,320 feet east of the southwest corner of sec. 30, T. 7 S., R. 5 W.

Ap—0 to 11 inches; brown (10YR 4/3) sandy loam, yellowish brown (10YR 5/4) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

E—11 to 16 inches; dark yellowish brown (10YR 4/6) sandy loam; weak fine subangular blocky structure; friable; common distinct clay films; about 12 percent pebbles; slightly acid; gradual wavy boundary.

Bt1—16 to 26 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium subangular blocky structure; firm; many distinct clay films; about 20 percent pebbles; medium acid; gradual wavy boundary.

Bt2—26 to 33 inches; brown (7.5YR 4/4) gravelly clay loam; moderate medium and coarse subangular blocky structure; friable; many distinct clay films; about 25 percent pebbles; medium acid; gradual wavy boundary.

BC—33 to 36 inches; dark yellowish brown (10YR 4/6) gravelly sandy loam; moderate medium granular structure; friable; about 20 percent pebbles; medium acid; gradual irregular boundary.

2C—36 to 60 inches; dark yellowish brown (10YR 4/4) very gravelly sand; single grain; loose; about 45 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches and corresponds with the depth to free carbonates. Reaction is slightly acid to strongly acid in the upper part of the solum and is neutral or mildly alkaline where the solum comes in contact with the calcareous gravelly sand. The content of pebbles ranges from 5 to 25 percent in the solum and from 20 to 55 percent in the 2C horizon.

The A horizon has value of 4 or 5 and chroma of 2 or 3. It is dominantly sandy loam, but the range includes fine sandy loam. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 or 4, and chroma of 3 to 5. It is dominantly gravelly clay loam, gravelly sandy clay loam, or gravelly loam, but the range includes clay loam, sandy clay loam, and loam. The 2C horizon is very gravelly sand, gravelly sand, or sand.

Gilford Series

The Gilford series consists of very poorly drained soils on outwash plains and moraines. These soils formed in sandy and loamy material. Permeability is moderately rapid in the upper part of the pedon and very rapid in the lower part. Slope is 0 to 1 percent.

Gilford soils are similar to Corunna soils and are commonly adjacent to Brady and Matherton soils. Corunna soils are underlain by loamy material. Brady and Matherton soils are somewhat poorly drained and are higher on the landscape than the Gilford soils.

Typical pedon of Gilford sandy loam, 1,200 feet east and 1,800 feet south of the northwest corner of sec. 24, T. 5 S., R. 8 W.

Ap—0 to 14 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; weak medium granular structure; friable; medium acid; abrupt smooth boundary.

Bg1—14 to 24 inches; grayish brown (2.5Y 5/2) sandy loam; few fine faint light yellowish brown (2.5Y 6/4) and few fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; medium acid; gradual wavy boundary.

Bg2—24 to 33 inches; grayish brown (2.5Y 5/2) sandy loam; few fine faint brownish yellow (10YR 6/6) and common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; firm; slightly acid; gradual wavy boundary.

2C1—33 to 47 inches; grayish brown (2.5Y 5/2) loamy sand; few fine faint light olive brown (2.5Y 5/6) mottles; single grain; loose; neutral; gradual wavy boundary.

2C2—47 to 58 inches; grayish brown (2.5Y 5/2) gravelly sand; single grain; about 15 percent pebbles; neutral; loose; gradual wavy boundary.

2Cg—58 to 60 inches; gray (10YR 5/1) gravelly sand; single grain; about 15 percent pebbles; loose; neutral.

The solum ranges from 20 to 40 inches in thickness. It commonly is slightly acid or neutral, but in some pedons it is medium acid. The 2C horizon ranges from slightly acid to moderately alkaline. The content of pebbles is 2 to 8 percent in the solum and 10 to 30 percent in the 2C horizon.

The A horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly sandy loam, but the range includes fine sandy loam. The Bg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly fine sandy loam or sandy loam. In some pedons, however, it has thin subhorizons of loam, sandy clay loam, clay loam, or loamy sand. Some pedons have a BC horizon. The 2C horizon has value of 5 to 7 and chroma of 1 to 3. It is loamy sand, sand, or gravelly sand.

Hatmaker Series

The Hatmaker series consists of somewhat poorly drained soils on till plains and moraines. These soils formed in loamy material and in the underlying silty material weathered from shale (fig. 10). Permeability is moderately rapid in the upper part of the pedon and moderately slow in the lower part. Slope ranges from 1 to 4 percent.

Hatmaker soils are commonly adjacent to Barry, Fox, and Locke soils. The adjacent soils are lower on the landscape than the Hatmaker soils. Barry soils are poorly drained. Fox soils are well drained and are underlain by sand and gravel. They are on outwash plains. Locke soils do not have shale within a depth of 60 inches.

Typical pedon of Hatmaker loam, 1 to 4 percent slopes, 1,640 feet east and 280 feet south of the northwest corner of sec. 6, T. 7 S., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (2.5Y 4/2) loam, light brownish gray (2.5Y 6/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

EB—8 to 15 inches; pale olive (5Y 6/3) loam; few fine distinct gray (10YR 5/1) and common fine prominent yellowish brown (10YR 5/4 and 10YR 5/8) mottles; moderate medium subangular blocky structure; firm; neutral; clear smooth boundary.

2Bt—15 to 19 inches; olive (5Y 5/3) silt loam; common medium distinct yellowish brown (10YR 5/4) and common medium prominent gray (N 5/0) mottles; strong medium angular blocky structure; firm; few prominent gray (N 5/0) clay films; common coarse

Figure 10.—Typical profile of Hatmaker loam, 1 to 4 percent slopes. This soil has many shale fragments.

dark concretions (iron and manganese oxides); about 10 percent shale fragments less than 6 inches in length; mildly alkaline; gradual wavy boundary.

2Btg1—19 to 31 inches; gray (5Y 5/1) silt loam; common medium distinct olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/4) mottles; strong medium angular blocky structure; firm; common prominent gray (N 5/0) clay films; common coarse dark concretions (iron and manganese oxides); about 10 percent shale fragments less than 6 inches in length; mildly alkaline; gradual wavy boundary.

2Btg2—31 to 39 inches; dark gray (5Y 4/1) silt loam; common medium distinct dark gray (N 4/1), olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/4) mottles; strong medium angular blocky structure; firm; common prominent dark gray (N 4/0) clay films; common coarse dark concretions (iron and manganese oxides); about 16 percent shale fragments less than 6 inches in length; mildly alkaline; gradual wavy boundary.

2Cg—39 to 60 inches; dark grayish brown (2.5Y 4/2) shaly silt loam; common medium distinct olive brown (2.5Y 4/4) and common fine distinct gray (N 5/0) mottles; massive; firm; common coarse dark concretions (iron and manganese oxides); about 20 percent shale fragments less than 6 inches in length; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 50 inches. The content of pebbles, which are mainly small shale fragments, ranges from 0 to 5 percent in the A horizon and from 2 to 30 percent in the 2B and 2C horizons.

The Ap horizon has hue of 10YR or 2.5Y, value of 4 or 5 (6 or 7 dry), and chroma of 2 or 3. It is dominantly loam, but the range includes fine sandy loam and sandy loam. This horizon is slightly acid or neutral. Some pedons have an A horizon. This horizon is 1 to 4 inches thick. It has hue of 10YR, 5Y, or 2.5Y, value of 4 to 6, and chroma of 2 to 4. The B part of the E/B horizon occurs as coatings, 2 to 5 millimeters thick, on vertical faces of peds. The 2B horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 to 3. It is silt loam, silty clay loam, or the shaly analogs of these textures. It is slightly acid to moderately alkaline. The 2C horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2. It is silt loam, silty clay loam, or the shaly analogs of these textures. It is slightly effervescent or strongly effervescent.

Hillsdale Series

The Hillsdale series consists of well drained, moderately permeable or moderately rapidly permeable soils on till plains and moraines. These soils formed in loamy material. Slope ranges from 2 to 12 percent.

Hillsdale soils are similar to Elmdale and Oshtemo soils and are commonly adjacent to Elmdale, Locke, Riddles, and Teasdale soils. Elmdale soils are moderately well drained. Oshtemo soils are underlain by sandy material. Locke and Teasdale soils are somewhat poorly drained and are lower on the landscape than the Hillsdale soils. Riddles soils are finer textured in the solum than the Hillsdale soils. They are on positions in the landscape similar to those of the Hillsdale soils.

Typical pedon of Hillsdale fine sandy loam, in an area of Hillsdale-Riddles fine sandy loams, 2 to 6 percent slopes, 2,500 feet north and 2,050 feet west of the southeast corner of sec. 1, T. 8 S., R. 6 W.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; neutral; gradual wavy boundary.
E—6 to 11 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; strongly acid; gradual wavy boundary.
Bt1—11 to 18 inches; yellowish brown (10YR 5/4) fine sandy loam; moderate medium subangular blocky structure; friable; common distinct dark yellowish brown (10YR 4/4) clay films; medium acid; gradual wavy boundary.
Bt2—18 to 27 inches; yellowish brown (10YR 5/4) fine sandy loam; strong medium and coarse subangular blocky structure; firm; many distinct dark yellowish brown (10YR 4/4) clay films; medium acid; gradual wavy boundary.
Bt3—27 to 37 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; common distinct dark reddish brown (5YR 3/4) clay films; medium acid; gradual wavy boundary.
BC1—37 to 48 inches; dark yellowish brown (10YR 4/6) sandy loam; weak medium subangular blocky structure; friable; medium acid; gradual wavy boundary.
BC2—48 to 66 inches; dark yellowish brown (10YR 4/6) sandy loam; weak fine subangular blocky structure; friable; medium acid; gradual wavy boundary.
C—66 to 70 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to more than 80 inches and generally corresponds with the depth to free carbonates. Reaction generally ranges from slightly acid to strongly acid in the solum, but the Ap horizon is neutral in recently limed areas. The content of pebbles ranges from 1 to 15 percent throughout the pedon.

The A horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam. The Bt horizon has value of 4 or 5 and chroma of 4 to 6. It is commonly fine sandy loam or sandy loam, but in some pedons it has subhorizons of sandy clay loam. The C horizon has value of 5 or 6 and chroma of 3 or 4. It is sandy loam or loamy sand.

Houghton Series

The Houghton series consists of very poorly drained soils in swamps, along drainageways, and in depressions on till plains, moraines, and outwash plains. These soils formed in deposits of organic material that are more than 51 inches thick. Permeability is moderately slow to moderately rapid. Slope is 0 to 1 percent.

Houghton soils are similar to Adrian, Edwards, and Palms soils and are commonly adjacent to Edwards, Gilford, and Ormas soils. Adrian soils are underlain by sandy material at a depth of 16 to 50 inches. Edwards soils are underlain by marl at a depth of 16 to 50 inches. Palms soils are underlain by loamy material. Gilford soils have a loamy solum. Ormas soils are well drained and have a mineral solum. Both Gilford and Ormas soils are higher on the landscape than the Houghton soils.

Typical pedon of Houghton muck, 2,140 feet south and 1,160 feet east of the northwest corner of sec. 19, T. 5 S., R. 7 W.

Oa1—0 to 9 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 5 percent fiber, a trace rubbed; weak fine granular structure; friable; neutral; abrupt smooth boundary.
Oa2—9 to 18 inches; very dark brown (10YR 2/2), broken face, and black (10YR 2/1), rubbed, sapric material; about 5 percent fiber, a trace rubbed; moderate medium subangular blocky structure; friable; neutral; gradual smooth boundary.
Oa3—18 to 27 inches; very dark brown (10YR 2/2), broken face and rubbed, sapric material; about 9 percent fiber, less than 2 percent rubbed; massive; firm; neutral; gradual smooth boundary.
Oa4—27 to 37 inches; very dark brown (10YR 2/2), broken face, and very dark grayish brown (10YR 3/2), rubbed, sapric material; about 18 percent fiber, 5 percent rubbed, massive; firm; neutral; gradual smooth boundary.
Oa5—37 to 52 inches; very dark brown (10YR 2/2), broken face and rubbed, sapric material; about 15 percent fiber, 5 percent rubbed; moderate thick platy structure; friable; neutral; gradual smooth boundary.
Oa6—52 to 60 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 15 percent fiber, less than 5 percent rubbed; massive; friable; neutral.

The thickness of the organic material is more than 51 inches. The fibers are primarily herbaceous, but some pedons have woody fragments 1 to 8 inches in diameter. The control section has hue of 10YR, 7.5YR, or N, value of 2 or 3, and chroma of 0 to 3. Reaction is medium acid to mildly alkaline throughout the pedon.

The surface tier is dominantly sapric material, but in some pedons it is hemic material or a combination of both sapric and hemic material. The subsurface tier is dominantly sapric, but some pedons have thin hemic or fibric layers. The combined thickness of the hemic layers is less than 10 inches, and that of the fibric layers is less than 5 inches.

Kidder Series

The Kidder series consists of well drained soils on till plains and moraines. These soils formed in loamy material. Permeability is moderate in the upper part of the pedon and moderately rapid in the lower part. Slope ranges from 2 to 12 percent.

Kidder soils are similar to Fox, Owosso, and Riddles soils and are commonly adjacent to Barry, Locke, Morley, and Teasdale soils. Fox soils are underlain by sandy material. Owosso soils are coarser textured in the upper part of the subsoil than the Kidder soils. Riddles soils have calcareous, loamy material below a depth of 40 inches. Barry soils are poorly drained and are lower on the landscape than the Kidder soils. Morley soils are finer textured than the Kidder soils. They are in positions on the landscape similar to those of the Kidder soils. Locke and Teasdale soils are somewhat poorly drained and are lower on the landscape than the Kidder soils.

Typical pedon of Kidder fine sandy loam, 2 to 6 percent slopes, 2,180 feet east and 1,980 feet south of the northwest corner of sec. 1, T. 8 S., R. 6 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) fine sandy loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; dark yellowish brown (10YR 4/4) loam; moderate medium angular blocky structure; friable; few faint yellowish brown (10YR 5/8) clay films; medium acid; clear smooth boundary.

Bt2—14 to 23 inches; dark yellowish brown (10YR 4/4) loam; moderate medium and coarse angular blocky structure; firm; common distinct yellowish brown (10YR 5/8) clay films; medium acid; gradual wavy boundary.

BC—23 to 30 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium subangular blocky structure; friable; medium acid; gradual wavy boundary.

C—30 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; friable; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches and corresponds with the depth to free carbonates. The content of pebbles in the solum ranges from 0 to 20 percent. The solum ranges from neutral to medium acid.

The Ap horizon has value of 3 or 4 (6 or more dry) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam and loam. Some pedons have an E horizon. The Bt horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4. It is loam, sandy clay loam, or clay loam. Some pedons do not have a BC horizon. The C horizon has value of 5 or 6 and chroma of 3 to 6. It is fine sandy loam, sandy loam, or the gravelly analogs of these textures.

Leoni Series

The Leoni series consists of well drained soils on outwash plains and moraines. These soils formed in gravelly and cobbly sandy and loamy material. Permeability is moderate in the upper part of the pedon and moderately rapid or rapid in the lower part. Slope ranges from 0 to 6 percent.

Leoni soils are commonly adjacent to Fox and Ormas soils. The adjacent soils are in positions on the landscape similar to those of the Leoni soils. They have fewer pebbles and cobbles than the Leoni soils. Ormas soils are sandy in the upper part of the solum and loamy in the lower part.

Typical pedon of Leoni gravelly sandy loam, 0 to 6 percent slopes, 3,000 feet east and 1,280 feet north of the southwest corner of sec. 10, T. 8 S., R. 6 W.

Ap—0 to 9 inches; brown (10YR 4/3) gravelly sandy loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; about 15 percent gravel and 5 percent cobbles; slightly acid; abrupt smooth boundary.

Bt1—9 to 17 inches; dark yellowish brown (10YR 3/6) gravelly sandy loam; moderate medium subangular blocky structure; friable; common distinct dark yellowish brown (10YR 3/4) clay films; about 20 percent gravel and 8 percent cobbles; neutral; clear smooth boundary.

Bt2—17 to 28 inches; yellowish red (5YR 5/6) very gravelly sandy clay loam; strong medium angular blocky structure; firm; many prominent brown (7.5YR 4/4) clay films; about 25 percent gravel and 15 percent cobbles; neutral; gradual wavy boundary.

Bt3—28 to 40 inches; dark reddish brown (5YR 3/4) very gravelly sandy clay loam; moderate medium angular blocky structure; friable; common prominent brown (7.5YR 4/4) clay films; about 25 percent gravel and 15 percent cobbles; neutral; gradual wavy boundary.

C—40 to 60 inches; yellowish brown (10YR 5/4) very gravelly sand; single grain; loose; about 40 percent pebbles and 15 percent cobbles; violent effervescence; strongly alkaline.

The thickness of the solum ranges from 30 to more than 60 inches and corresponds with the depth to free carbonates. The solum commonly is slightly acid to neutral, but in some pedons it is medium acid to mildly alkaline.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly gravelly sandy loam, but the range includes gravelly or cobbly loam and cobbly sandy loam. The content of pebbles and cobbles in this horizon is 15 to 40 percent. Some pedons have A and E horizons. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 4 to 6. It is gravelly, very gravelly,

extremely gravelly, or cobbly sandy clay loam, clay loam, or sandy loam. The content of pebbles and cobbles combined is 35 to 75 percent of the Bt horizon. Some pedons have a BC horizon. The C horizon has value of 4 to 6 and chroma of 2 to 4. It is the very gravelly, extremely gravelly, or cobbly analogs of sand, loamy sand, or sandy loam. The content of the pebbles and cobbles in this horizon is 35 to 75 percent.

Locke Series

The Locke series consists of somewhat poorly drained, moderately permeable soils on till plains and moraines. These soils formed in loamy material. Slope ranges from 1 to 4 percent.

Locke soils are similar to Matherton soils and are commonly adjacent to Barry, Kidder, and Teasdale soils. Matherton soils are underlain by gravelly sand. Barry soils are poorly drained and are lower on the landscape than the Locke soils. Kidder soils are well drained and are higher on the landscape than the Locke soils. Teasdale soils have less clay in the solum than the Locke soils. They are in positions on the landscape similar to those of the Locke soils.

Typical pedon of Locke fine sandy loam, 1 to 4 percent slopes, 940 feet east and 100 feet south of the northwest corner of sec. 3, T. 6 S., R. 7 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

Bt1—9 to 22 inches; dark yellowish brown (10YR 4/4) sandy clay loam; many coarse distinct grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable; common distinct dark grayish brown (10YR 4/2) clay films; neutral; clear smooth boundary.

Bt2—22 to 31 inches; yellowish brown (10YR 5/4) loam; common medium distinct yellowish brown (10YR 5/8) and many coarse distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few faint clay films; neutral; clear smooth boundary.

C—31 to 60 inches; yellowish brown (10YR 5/4) sandy loam; many coarse distinct yellowish brown (10YR 5/8) and many coarse distinct gray (10YR 5/1) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 40 inches and corresponds with the depth to free carbonates. The content of pebbles ranges from 2 to 10 percent throughout the pedon. Reaction ranges from medium acid to neutral in the solum and from neutral to moderately alkaline in the C horizon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes sandy loam and loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is loam, sandy loam, or sandy clay loam. Some pedons have a BC horizon. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is loam or sandy loam.

Matherton Series

The Matherton series consists of somewhat poorly drained soils on outwash plains and moraines. These soils formed in loamy glaciofluvial material underlain by sand and gravel. Permeability is moderate in the upper part of the pedon and rapid or very rapid in the lower part. Slope ranges from 0 to 3 percent.

Matherton soils are similar to Locke soils and are commonly adjacent to Fox and Sebewa soils. Locke soils are underlain by loamy material. Fox soils are well drained and are higher on the landscape than the Matherton soils. Sebewa soils are poorly drained and are lower on the landscape than the Matherton soils.

Typical pedon of Matherton sandy loam, 0 to 3 percent slopes, 1,740 feet east and 260 feet south of the northwest corner of sec. 14, T. 8 S., R. 7 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

Bt1—9 to 18 inches; brown (10YR 5/3) clay loam; few medium distinct yellowish brown (10YR 5/8) and few fine faint dark grayish brown (10YR 4/2) mottles; moderate medium angular blocky structure; friable; many distinct dark grayish brown (10YR 4/2) clay films; slightly acid; clear smooth boundary.

Bt2—18 to 27 inches; brown (10YR 4/3) gravelly clay loam; common fine faint dark grayish brown (10YR 4/2) and few fine distinct yellowish brown (10YR 5/8) mottles; weak medium angular blocky structure; friable; many distinct dark grayish brown (10YR 4/2) clay films; about 20 percent pebbles; neutral; clear smooth boundary.

2C—27 to 60 inches; light yellowish brown (2.5Y 6/4) gravelly sand; single grain; loose; about 15 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 40 inches and corresponds with the depth to free carbonates. Reaction ranges from medium acid to neutral in the solum. The content of pebbles ranges from 0 to 25 percent in the solum and from 10 to 55 percent in the 2C horizon.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. Some pedons have A and E horizons. The Ap horizon is dominantly sandy loam, but the range includes fine sandy loam and loam. The B horizon has hue of 10YR or

2.5Y, value of 4 to 6, and chroma of 2 or 3. It is clay loam, sandy clay loam, loam, or the gravelly analogs of these textures. In some pedons it has thin subhorizons of fine sandy loam or sandy loam. Some pedons have a BC horizon. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 to 4. It is gravelly sand, sand, or stratified sand and gravelly sand.

Morley Series

The Morley series consists of well drained soils on till plains and moraines. These soils formed in silty material. Permeability is moderately slow or slow. Slope ranges from 1 to 12 percent.

Morley soils are commonly adjacent to Kidder and Locke soils. Kidder soils are coarser textured than the Morley soils. They are in positions on the landscape similar to those of the Morley soils. Locke soils are somewhat poorly drained and are lower on the landscape than the Morley soils.

Typical pedon of Morley silt loam, 1 to 6 percent slopes, 250 feet north and 30 feet east of the southwest corner of sec. 22, T. 8 S., R. 5 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

BA—9 to 13 inches; brown (10YR 5/3) silt loam; moderate fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bt1—13 to 18 inches; brown (10YR 5/3) silty clay loam; strong fine angular blocky structure; firm; common distinct dark brown (10YR 4/3) clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bt2—18 to 27 inches; yellowish brown (10YR 5/4) silty clay loam; strong medium angular blocky structure; firm; many prominent dark brown (10YR 4/3) clay films on faces of peds; about 1 percent pebbles; mildly alkaline; clear wavy boundary.

C—27 to 60 inches; brown (10YR 5/3) silty clay loam; massive; firm; about 1 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 30 inches and corresponds with the depth to free carbonates. The content of pebbles ranges from 0 to 5 percent throughout the pedon. The solum ranges from slightly acid to moderately alkaline.

The Ap horizon has value of 3 or 4 (5 or 6 dry) and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is silty clay loam or silty clay. The C horizon has value of 5 or 6 and chroma of 3 or 4.

Ormas Series

The Ormas series consists of well drained, moderately rapidly permeable soils on outwash plains. These soils formed in sandy and loamy material. Slope ranges from 0 to 6 percent.

Ormas soils are similar to Branch soils and are commonly adjacent to Branch and Oshtemo soils. Branch soils are moderately well drained. Oshtemo soils do not have more than 20 inches of sandy material over a loamy subsoil layer. They are in positions on the landscape similar to those of the Ormas soils.

Typical pedon of Ormas loamy sand, 0 to 6 percent slopes, 140 feet south and 1,200 feet east of the northwest corner of sec. 23, T. 8 S., R. 8 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) loamy sand, pale brown (10YR 6/3) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

E—8 to 29 inches; yellowish brown (10YR 5/6) loamy sand; weak fine subangular blocky structure; friable; about 8 percent pebbles; medium acid; gradual smooth boundary.

Bt1—29 to 37 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium angular blocky structure; firm; about 8 percent pebbles; medium acid; gradual wavy boundary.

Bt2—37 to 51 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium and coarse angular blocky structure; friable; about 12 percent pebbles; medium acid; gradual wavy boundary.

2C—51 to 60 inches; brownish yellow (10YR 6/6) gravelly sand; loose; about 20 percent pebbles; strong effervescence; moderately alkaline.

The solum ranges from 45 to 80 inches in thickness. It is slightly acid to strongly acid. The content of pebbles in the lower part of the solum and in the 2C horizon ranges from 5 to 30 percent.

The A horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly loamy sand, but the range includes loamy fine sand and sand. Some pedons have a BA horizon. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam, sandy clay loam, gravelly sandy loam, or gravelly sandy clay loam. Some pedons have a BC horizon. The C horizon is dominantly gravelly sand or sand, but in some pedons it has thick strata of sand or coarse sand.

Oshtemo Series

The Oshtemo series consists of well drained, moderately rapidly permeable soils on outwash plains. These soils formed in sandy and loamy material. Slope ranges from 0 to 25 percent.

Oshtemo soils are similar to Hillsdale soils and are commonly adjacent to Bronson and Gilford soils.

Hillsdale soils are underlain by loamy material. The moderately well drained Bronson soils and the very poorly drained Gilford soils are lower on the landscape than the Oshtemo soils.

Typical pedon of Oshtemo sandy loam, 0 to 6 percent slopes, 2,100 feet south and 450 feet west of the northeast corner of sec. 14, T. 6 S., R. 5 W.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) sandy loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; slightly acid; abrupt smooth boundary.

Bt1—11 to 19 inches; dark yellowish brown (10YR 4/4) sandy loam; few faint discontinuous dark brown (7.5YR 4/4) clay films; weak medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

Bt2—19 to 27 inches; dark brown (7.5YR 4/4) sandy clay loam; common distinct yellowish red (5YR 4/6) clay films; moderate medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

Bt3—27 to 33 inches; dark brown (7.5YR 4/4) sandy loam; common faint dark reddish brown (5YR 3/3) clay films; weak medium subangular blocky structure; friable; slightly acid; gradual wavy boundary.

BC—33 to 45 inches; dark yellowish brown (10YR 4/6) loamy sand; weak medium subangular blocky structure; very friable; slightly acid; gradual wavy boundary.

2C—45 to 60 inches; yellowish brown (10YR 5/4) gravelly sand; single grain; loose; about 20 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 66 inches and corresponds with the depth to free carbonates. Reaction ranges from slightly acid to strongly acid in the solum. The content of pebbles ranges from 1 to 25 percent in the solum and from 10 to 55 percent in the 2C horizon.

The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly sandy loam, but the range includes loamy sand. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 3 to 6. It is dominantly sandy loam, gravelly sandy loam, or sandy clay loam. In some pedons, however, the lower part of this horizon occurs as bands that are 1/8 inch to 4 inches thick and are separated by sand or loamy sand. Some pedons do not have a BC horizon. The 2C horizon has value of 5 or 6 and chroma of 2 to 4. It is gravelly sand, very gravelly sand, sand, or stratified sand and gravel.

Owosso Series

The Owosso series consists of well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy material. Slope ranges from 2 to 6 percent.

Owosso soils are similar to Kidder and Riddles soils and are commonly adjacent to Locke and Teasdale soils. Kidder and Riddles soils are finer textured in the upper part of the solum than the Owosso soils. Locke and Teasdale soils are somewhat poorly drained and are lower on the landscape than the Owosso soils.

Typical pedon of Owosso sandy loam, 2 to 6 percent slopes, 100 feet west and 2,080 feet south of the northeast corner of sec. 2, T. 7 S., R. 6 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

BA—10 to 23 inches; brownish yellow (10YR 6/6) sandy loam; moderate medium angular blocky structure; friable; medium acid; clear wavy boundary.

Bt1—23 to 30 inches; yellowish brown (10YR 5/6) loam; moderate medium angular blocky structure; firm; common distinct brown (10YR 4/3) clay films; medium acid; clear wavy boundary.

2Bt2—30 to 41 inches; yellowish brown (10YR 5/6) clay loam; strong medium to coarse angular blocky structure; firm; many prominent brown (10YR 4/3) clay films; medium acid; gradual wavy boundary.

2Bt3—41 to 50 inches; yellowish brown (10YR 5/4) clay loam; strong medium to coarse angular blocky structure; firm; many faint dark yellowish brown (10YR 4/4) clay films; medium acid; gradual wavy boundary.

3C—50 to 60 inches; yellowish brown (10YR 5/4) sandy loam; massive; firm; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 50 inches and corresponds with the depth to free carbonates. Reaction ranges from medium acid to neutral in the solum.

The Ap horizon has value of 4 to 6 and chroma of 2 to 4. It is dominantly sandy loam, but the range includes fine sandy loam and loamy sand. Some pedons have A and E horizons. The BA horizon has value of 4 to 6 and chroma of 3 to 6. It is sandy loam, fine sandy loam, or loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, sandy loam, or fine sandy loam. The 2Bt horizon has value of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay loam, or loam. Some pedons have a 2C horizon. This horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. It is clay loam, silty clay loam, or loam. The 3C horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is fine sandy loam, sandy loam, or loam.

Palms Series

The Palms series consists of very poorly drained soils in swamps, along drainageways, and in depressions on till plains, moraines, and outwash plains. These soils formed in deposits of organic material 16 to 50 inches deep over loamy material. Permeability is moderately slow to moderately rapid in the upper part of the pedon and moderately slow or moderate in the lower part. Slope is 0 to 1 percent.

Palms soils are similar to Adrian, Edwards, and Houghton soils and are commonly adjacent to Adrian, Barry, and Houghton soils. Adrian soils are underlain by sandy material. Edwards soils are underlain by marl. Houghton soils are organic throughout. Barry soils are loamy throughout and are slightly higher on the landscape than the Palms soils.

Typical pedon of Palms muck, 100 feet south and 2,560 feet west of the northeast corner of sec. 2, T. 6 S., R. 5 W.

Oa1—0 to 8 inches; black (N 2/0), broken face, and black (10YR 2/1), rubbed, sapric material; about 6 percent fiber, less than 2 percent rubbed; weak fine granular structure; friable; neutral; abrupt wavy boundary.

Oa2—8 to 17 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 11 percent fiber, 3 percent rubbed; moderate medium subangular blocky structure; friable; neutral; clear wavy boundary.

Oa3—17 to 31 inches; very dark brown (10YR 2/2), broken face and rubbed, sapric material; about 11 percent fiber, 3 percent rubbed; moderate coarse subangular blocky structure; friable; neutral; clear wavy boundary.

C—31 to 60 inches; dark grayish brown (10YR 4/2) clay loam; massive; friable; lenses of dark grayish brown (2.5Y 4/2) sandy loam; slight effervescence; mildly alkaline.

The depth to the C horizon ranges from 16 to 50 inches. The fibers are primarily herbaceous. In some pedons, however, as much as 15 percent of the organic material is coarse woody fragments of twigs, branches, or logs. The organic layers are dominantly sapric, but some pedons have thin hemic or fibric layers. The organic material ranges from medium acid to mildly alkaline. The rubbed fiber content is commonly less than 10 percent throughout the pedon.

The surface tier has value of 2 and chroma of 1 or 2. The subsurface and bottom tiers have hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 0 to 3, broken face and rubbed. The content of mineral material in the organic horizon immediately above the loamy C horizon is as much as 50 percent. The C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. It is clay loam, silt loam, silty clay loam, or loam. It ranges from slightly acid to moderately alkaline.

Riddles Series

The Riddles series consists of well drained, moderately permeable soils on till plains and moraines. These soils formed in loamy glacial till. Slope ranges from 2 to 12 percent.

Riddles soils are similar to Fox, Kidder, and Owosso soils and are commonly adjacent to Elmdale, Hillsdale, Locke, and Teasdale soils. Fox soils are underlain by sandy material. Kidder soils have calcareous, loamy material within a depth of 40 inches. Owosso soils typically have more than 20 inches of sandy loam over the fine-loamy part of the pedon. Elmdale soils are moderately well drained and are lower on the landscape than the Riddles soils. Hillsdale soils are coarser textured in the solum than the Riddles soils. They are in positions on the landscape similar to those of the Riddles soils. Locke and Teasdale soils are somewhat poorly drained and are lower on the landscape than the Riddles soils.

Typical pedon of Riddles fine sandy loam, in an area of Hillsdale-Riddles fine sandy loams, 2 to 6 percent slopes, 2,330 feet north and 2,045 feet west of the southeast corner of sec. 1, T. 8 S., R. 6 W.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; neutral; clear wavy boundary.

E—6 to 11 inches; brownish yellow (10YR 6/6) fine sandy loam; moderate medium and fine angular blocky structure; friable; strongly acid; clear wavy boundary.

Bt1—11 to 26 inches; yellowish brown (10YR 5/6) loam; moderate medium angular blocky structure; firm; many distinct clay films; strongly acid; clear wavy boundary.

Bt2—26 to 36 inches; dark yellowish brown (10YR 4/6) loam; moderate medium angular blocky structure; firm; many distinct clay films; strongly acid; gradual wavy boundary.

BC—36 to 54 inches; dark yellowish brown (10YR 4/6) fine sandy loam; moderate medium angular blocky structure; friable; strongly acid; gradual wavy boundary.

C—54 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 72 inches and generally corresponds with the depth to free carbonates. The solum is slightly acid to strongly acid. The content of pebbles ranges from 1 to 10 percent throughout the solum.

The A horizon has value of 3 to 5 and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam. The Bt horizon has value of 4 to 6 and chroma of 3 to 6. It is commonly loam, but in some pedons it has subhorizons of fine sandy loam, sandy loam, clay loam, or sandy clay loam. Some pedons do not have a BC horizon. The C horizon has value of 5 or 6 and chroma of 3 or 4. It is fine sandy loam or loam.

Sebewa Series

The Sebewa series consists of poorly drained soils in depressions on outwash plains and moraines. These soils formed in loamy material underlain by sand and gravel. Permeability is moderate in the upper part of the pedon and rapid in the lower part. Slope is 0 to 1 percent.

Sebewa soils are similar to Barry soils and are commonly adjacent to Branch, Locke, and Matherton soils. Barry soils are underlain by loamy material. The moderately well drained Branch soils and the somewhat poorly drained Locke and Matherton soils are higher on the landscape than the Sebewa soils.

Typical pedon of Sebewa loam, 1,600 feet west and 3,280 feet south of the northeast corner of sec. 1, T. 8 S., R. 7 W.

Ap—0 to 12 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

Btg1—12 to 20 inches; grayish brown (2.5Y 5/2) loam; common medium distinct strong brown (7.5YR 5/6) mottles; strong medium angular blocky structure; firm; common distinct clay films on faces of peds; slightly acid; clear smooth boundary.

Btg2—20 to 31 inches; dark gray (10YR 4/1) loam; few medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common distinct clay films on faces of peds; few lenses of sandy loam; neutral; clear smooth boundary.

2Cg—31 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; slight effervescence; mildly alkaline.

The solum ranges from 20 to 40 inches in thickness. It is slightly acid to mildly alkaline. The depth to free carbonates ranges from 18 to 36 inches. The content of pebbles ranges from 0 to 15 percent throughout the pedon.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It ranges from 8 to 15 inches in thickness. It is dominantly loam, but the range includes silt loam, clay loam, and sandy loam. Some pedons have E and BA horizons. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is loam, sandy clay loam, clay loam, or gravelly clay loam. The 2Cg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is sand, gravelly sand, or stratified sand and gravel.

Spinks Series

The Spinks series consists of well drained, moderately rapidly permeable soils on outwash plains and moraines. These soils formed in sandy material. Slope ranges from 0 to 6 percent.

Spinks soils are commonly adjacent to Branch, Ormas, Oshtemo, and Thetford soils. Branch soils are moderately well drained and are lower on the landscape than the Spinks soils. Ormas and Oshtemo soils are finer textured in the solum than the Spinks soils. They are in positions on the landscape similar to those of the Spinks soils. Thetford soils are somewhat poorly drained and are lower on the landscape than the Spinks soils.

Typical pedon of Spinks loamy fine sand, 0 to 6 percent slopes, 495 feet west and 2,390 feet north of the southeast corner of sec. 1, T. 6 S., R. 5 W.

Ap—0 to 11 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; medium acid; abrupt smooth boundary.

E—11 to 20 inches; yellowish brown (10YR 5/4) loamy fine sand; weak medium subangular blocky structure; friable; strongly acid; gradual irregular boundary.

E&Bt—20 to 52 inches; light yellowish brown (10YR 6/4) fine sand (E); single grain; loose; discontinuous lamellae of strong brown (7.5YR 4/6) loamy fine sand (Bt); moderate medium subangular blocky structure in the thicker bands; friable; medium acid; gradual wavy boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; neutral.

The solum ranges from 36 to more than 60 inches in thickness. It commonly ranges from medium acid to neutral. In many pedons, however, the lower part of the E&Bt horizon is mildly alkaline.

The A horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly loamy fine sand, but the range includes loamy sand. The E horizon has value of 4 to 6 and chroma of 3 to 6. It is loamy fine sand, loamy sand, or fine sand. The Bt part of the E&Bt horizon occurs as lamellae 1/8 inch to 5 inches thick. It has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is loamy fine sand, loamy sand, sand, fine sand, or sandy loam. The C horizon has value of 5 to 7 and chroma of 3 or 4. It is sand or fine sand. It ranges from neutral to moderately alkaline

Teasdale Series

The Teasdale series consists of somewhat poorly drained, moderately permeable soils on till plains and moraines. These soils formed in loamy material. Slope ranges from 0 to 3 percent.

Teasdale soils are commonly adjacent to Barry, Hillsdale, and Elmdale soils. Barry soils are poorly drained and are lower on the landscape than the Teasdale soils. Hillsdale soils are well drained and are higher on the landscape than the Teasdale soils. Elmdale soils are moderately well drained.

Typical pedon of Teasdale fine sandy loam, 0 to 3 percent slopes, 160 feet north and 2,440 feet east of the southwest corner of sec. 18, T. 6 S., R. 7 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; 3 to 5 percent pebbles; neutral; abrupt smooth boundary.

B/E—9 to 18 inches; yellowish brown (10YR 5/4) fine sandy loam (B); few fine faint yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; interfingers of light yellowish brown (10YR 6/4) fine sandy loam (E); weak fine granular structure; friable; few faint clay films; about 3 percent cobbles and 5 percent pebbles; medium acid; gradual wavy boundary.

Bt1—18 to 27 inches; dark yellowish brown (10YR 4/6) fine sandy loam; few fine faint light brownish gray (10YR 6/2) and pale brown (10YR 6/3) and many coarse distinct yellowish brown (10YR 5/8) mottles; strong coarse subangular blocky structure; firm; common distinct dark brown (10YR 3/3) clay films; about 3 percent cobbles and 5 percent pebbles; medium acid; gradual wavy boundary.

Bt2—27 to 45 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine faint light gray (10YR 7/1), few fine distinct dark yellowish brown (10YR 3/6), and many coarse distinct dark yellowish brown (10YR 4/6) mottles; strong coarse subangular blocky structure; firm; common distinct dark brown (10YR 3/3) clay films; about 5 percent cobbles and 8 percent pebbles; medium acid; gradual wavy boundary.

BC—45 to 57 inches; mixed yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and brown (10YR 5/3) fine sandy loam; strong medium subangular blocky structure; firm; medium acid; gradual wavy boundary.

C—57 to 60 inches; yellowish brown (10YR 5/4) fine sandy loam; few fine distinct brownish yellow (10YR 6/8) mottles; massive; friable; neutral.

The thickness of the solum ranges from 40 to 60 inches and corresponds with the depth to free carbonates. The content of pebbles in the solum ranges from 3 to 20 percent.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loam, sandy loam, and the gravelly or cobbly analogs of these textures. Some pedons have an E horizon. This horizon has value of 5 or 6 and chroma of 2 to 4. It has textures that are similar to those of the A horizon. The E part of the B/E horizon occurs as coatings, 2 to 5 millimeters thick, on vertical faces of peds. It has colors similar to those of the E horizon. The B part of the B/E horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam, sandy loam, or loam. The B/E horizon is strongly acid to neutral. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is fine sandy loam, sandy loam, loam, or the gravelly or cobbly analogs of these textures. Some pedons have a BC horizon. The C horizon is fine sandy loam, sandy loam, or loamy sand. It ranges from neutral to moderately alkaline.

Thetford Series

The Thetford series consists of somewhat poorly drained, moderately rapidly permeable soils on outwash plains and moraines. These soils formed in sandy material. Slope ranges from 0 to 3 percent.

Thetford soils are commonly adjacent to Gilford, Ormas, and Spinks soils. Gilford soils are very poorly drained and are lower on the landscape than the Thetford soils. Ormas and Spinks soils are well drained and are higher on the landscape than the Thetford soils.

Typical pedon of Thetford loamy fine sand, 0 to 3 percent slopes, 320 feet south and 2,000 feet east of the northwest corner of sec. 24, T. 5 S., R. 8 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy fine sand, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

E—8 to 14 inches; yellowish brown (10YR 5/6) loamy fine sand; common medium distinct yellowish brown (10YR 5/8) and common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; slightly acid; gradual wavy boundary.

E&Bt—14 to 42 inches; light yellowish brown (10YR 6/4) fine sand (E); few fine distinct strong brown (7.5YR 5/8) mottles; single grain; loose; lamellae of brown (7.5YR 5/4) fine sandy loam (Bt); few fine distinct strong brown (7.5YR 4/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure in the thicker bands; firm; clay bridging between sand grains; medium acid; gradual wavy boundary.

C—42 to 80 inches; pale brown (10YR 6/3) fine sand; many medium distinct yellowish brown (10YR 5/4 and 5/8) mottles; weak fine subangular blocky

structure; very friable; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to more than 60 inches. Reaction ranges from medium acid to neutral in the solum and is mildly alkaline or moderately alkaline in the C horizon.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly loamy fine sand, but the range includes fine sand and loamy sand. Some pedons have a BA horizon. The Bt horizon has value of 4 to 6 and chroma of 3 to 6. It is loamy fine sand, fine sand, or loamy sand. The E part of the E&B horizon has value of 4 to 6 and chroma of 3 or 4. It is fine sand, loamy sand, or loamy fine sand. The Bt part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is fine sandy loam, sandy loam, loamy fine sand, or loamy sand. It occurs as lamellae 1/4 inch to 3 inches thick. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is dominantly fine sand, sand, or very fine sand. In some pedons, however, it has layers with finer textures.

Formation of the Soils

This section relates the factors of soil formation to the soils in Branch County and explains the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors—the physical, chemical, and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material (*3*).

Climate and plant and animal life are the active forces in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material affects the kind of soil profile that forms. In extreme cases, it determines the soil profile almost entirely. Finally, time is needed for changing the parent material into a soil.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material, the unconsolidated mass in which a soil forms, determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils in Branch County were deposited by glaciers or by glacial meltwater. The glaciers covered the county 10,000 to 12,000 years ago. Some of these materials have been reworked and redeposited by the subsequent action of water and wind. Although most of the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Branch County were deposited as glacial till, outwash, alluvium, and organic material.

Glacial till was deposited directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Branch County is calcareous sandy loam or loam. Riddles soils are an example of soils that formed in glacial till. Typically, they are loamy and have a moderately well developed structure.

Outwash material was deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried them. As the speed of the stream decreased, the coarser particles were deposited. Slowly moving water carried the finer particles, such as very fine sand, silt, and clay. Outwash deposits generally occur as layers of particles of similar size, such as sandy loam, sand, gravel, and other coarse particles. Oshtemo soils are an example of soils that formed in deposits of outwash.

Alluvium is material recently deposited by floodwater from streams. The texture of this alluvium is determined by the speed of the water that deposited the material. Alluvium deposited by a swift stream is coarser textured than that deposited by a slow, sluggish stream. Cohoctah soils are examples of soils that formed in alluvium.

Organic material occurs as deposits of plant remains. After the glaciers receded, water was left standing in depressions in outwash plains and till plains. Because of the wetness, the grasses and sedges that grew around the edges of these depressions did not decompose quickly after they died. Later, water-tolerant trees grew in these areas. As the trees died, their remains became part of the organic accumulation. The depressions eventually filled with organic material and developed into areas of muck. Houghton soils are an example of soils that formed in organic material.

Plant and Animal Life

Green plants have been the principal organisms that have influenced soil formation in Branch County. Bacteria, fungi, earthworms, and human activities also have been important. Plant and animal life contribute organic matter and nitrogen to the soil. The kind of organic material in the soil depends on the kinds of plants that grew on the soil in the past. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. Plant roots provided channels for the downward movement of water through the soil and added organic matter as they decayed. Bacteria in the soil help to break down the organic matter into plant nutrients.

The native vegetation in Branch County was mainly deciduous trees. Differences in natural soil drainage and variations in the parent material affected the composition of the forest species. The well drained upland soils, such as Fox and Oshtemo soils, were covered mainly by maple, oak, and hickory. The vegetation on Spinks soils was scrub oak. Generally, the wet soils were covered by soft maple, elm, and ash. Examples are Gilford and Sebewa soils, which contain a considerable amount of organic matter.

Climate

Climate determines the kind of plant and animal life on and in the soil and the amount of water available for the weathering of minerals and for the transporting of soil material. Through its influence on soil temperature, climate also determines the rate of chemical reaction in the soil.

The climate in Branch County, which is presumably similar to that under which the soils formed, is cool and humid. The soils in the county differ from the soils that formed under a dry, warm climate or under a moist, hot climate. Although climate is uniform throughout the county, its effect is modified locally, depending on the proximity to large lakes. Differences in climate account for only minor differences among the soils in the county.

Relief

Relief has markedly affected soil formation in Branch County. Natural drainage, runoff, erosion, plant cover, and soil temperature are affected by relief. Slopes range from 0 to 25 percent in the county. The soils range from excessively drained on ridgetops to very poorly drained in depressions. Through its effect on soil aeration, drainage determines the color of the soil. Runoff is most rapid on the steeper slopes. In low areas water ponds temporarily. Water and air move freely through well drained soils and slowly through very poorly drained soils. In Fox and other well aerated soils, the iron and aluminum compounds are brightly colored and oxidized. Sebewa and other poorly aerated soils are dull gray and mottled. Fox and Sebewa soils formed in similar kinds of parent material.

Time

Generally, a long time is needed for the development of distinct horizons. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in Branch County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming processes long enough for the development of distinct horizons. The soils that formed in recent alluvial sediments, however, have not been in place long enough for the development of distinct horizons. Cohoctah soils are an example of young alluvial soils. Fox soils, which formed in loamy and sandy sediments on outwash plains, are an example of mature soils.

Processes of Soil Formation

The processes responsible for the development of soil horizons in the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the horizons are referred to as soil morphology.

Several processes are involved in the development of soil horizons—the accumulation of organic matter, the leaching of lime (calcium carbonate) and other bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes have been active in the development of distinct horizons.

As organic matter accumulates on the surface of a soil, an A horizon forms. If the soil is plowed, this horizon is mixed into a plow layer, or Ap horizon. In the soils in Branch County, the surface layer ranges from high to low in content of organic matter. Sebewa soils are an example of soils that have a high content of organic matter in the surface layer. Spinks soils are an example of soils that have a low content of organic matter.

Carbonates and other bases have been leached from most of the soils. The leaching of bases generally precedes the translocation of silicate clay minerals. Many of the soils in Branch County are moderately leached or strongly leached. For example, Riddles soils are leached of carbonates to a depth of 54 inches and Sebewa soils are leached to a depth of only 31 inches. This difference in the depth of leaching is a result of the length of time that the soils have been forming.

Gleying, or the reduction and transfer of iron, is evident in somewhat poorly drained, poorly drained, and very poorly drained soils. The gray subsoil in these soils indicates the reduction and transfer of iron. Sebewa soils are an example of gleyed soils.

In some soils the translocation of clay minerals has contributed to horizon development. An eluviated, or leached, E horizon typically has platy structure, is lower in content of clay than the illuviated B horizon, and is lighter in color. The B horizon typically has an accumulation of clay, or clay films, in pores and on faces of peds. Soils at this stage of formation were probably leached of carbonates and soluble salts to a considerable extent before the silicate clays were translocated. Riddles soils are an example.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the

activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a

soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Much has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, In order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam,*

silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-80 at Coldwater, Michigan]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	30.2	14.5	22.3	56	-12	0	1.72	0.9	2.5	5	11.9
February---	33.7	16.3	25.0	58	-12	0	1.56	.8	2.3	4	9.3
March------	43.7	25.2	34.4	73	0	12	2.36	1.5	3.1	6	7.7
April------	57.8	36.1	46.9	81	17	86	3.48	2.3	4.6	8	2.3
May--------	69.4	46.2	57.8	88	27	276	3.03	2.0	4.0	7	**
June-------	78.9	55.6	67.2	94	37	525	3.73	2.2	5.1	7	.0
July-------	82.4	59.3	70.9	95	44	655	4.01	2.3	5.5	7	.0
August-----	80.8	57.6	69.2	94	40	602	3.40	1.6	4.9	6	.0
September--	74.1	50.7	62.4	92	31	384	3.03	1.3	4.5	6	.1
October----	62.3	40.4	51.4	84	20	142	2.60	1.3	3.8	6	.4
November---	47.2	30.7	39.0	71	9	24	2.38	1.6	3.1	6	5.4
December---	35.2	20.2	27.7	61	-8	0	2.19	1.0	3.2	5	10.6
Year-----	58.0	37.7	47.8	97	-15	2,706	33.49	28.2	38.5	74	47.8

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

** Trace.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 22	May 9	May 20
2 years in 10 later than--	Apr. 18	May 4	May 16
5 years in 10 later than--	Apr. 10	Apr. 25	May 7
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 14	Oct. 3	Sept. 21
2 years in 10 earlier than--	Oct. 20	Oct. 9	Sept. 25
5 years in 10 earlier than--	Nov. 1	Oct. 19	Oct. 4

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	180	157	130
8 years in 10	189	164	137
5 years in 10	205	176	150
2 years in 10	220	188	163
1 year in 10	229	195	171

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2B	Kidder fine sandy loam, 2 to 6 percent slopes	4,615	1.4
2C	Kidder fine sandy loam, 6 to 12 percent slopes	680	0.2
4B	Oshtemo sandy loam, 0 to 6 percent slopes	15,350	4.6
4C	Oshtemo sandy loam, 6 to 12 percent slopes	760	0.2
4E	Oshtemo sandy loam, 12 to 25 percent slopes	755	0.2
5B	Hillsdale-Riddles fine sandy loams, 2 to 6 percent slopes	23,370	7.1
5C	Hillsdale-Riddles fine sandy loams, 6 to 12 percent slopes	2,405	0.7
6	Gilford sandy loam	3,605	1.1
7B	Hatmaker loam, 1 to 4 percent slopes	6,875	2.1
8	Cohoctah sandy loam	6,040	1.8
9A	Matherton sandy loam, 0 to 3 percent slopes	16,140	4.9
10A	Brady sandy loam, 0 to 2 percent slopes	4,150	1.2
11B	Elmdale fine sandy loam, 2 to 6 percent slopes	7,720	2.3
12A	Teasdale fine sandy loam, 0 to 3 percent slopes	14,675	4.4
14	Houghton muck	10,100	3.0
15B	Locke fine sandy loam, 1 to 4 percent slopes	55,170	16.7
17	Barry loam	23,670	7.2
18B	Spinks loamy fine sand, 0 to 6 percent slopes	2,165	0.7
19	Barry loam, shaly substratum	1,000	0.3
20	Adrian muck	7,020	2.1
21A	Bronson sandy loam, 0 to 3 percent slopes	2,640	0.8
22	Palms muck	2,665	0.8
24	Sebewa loam	17,180	5.2
25B	Branch loamy sand, 1 to 4 percent slopes	8,040	2.4
26	Edwards muck	9,795	2.9
27A	Fox sandy loam, 0 to 2 percent slopes	21,425	6.5
27B	Fox sandy loam, 2 to 6 percent slopes	30,440	9.2
27C	Fox sandy loam, 6 to 12 percent slopes	2,770	0.8
29B	Morley silt loam, 1 to 6 percent slopes	1,765	0.5
29C	Morley silt loam, 6 to 12 percent slopes	480	0.1
30B	Leoni gravelly sandy loam, 0 to 6 percent slopes	1,980	0.6
32A	Thetford loamy fine sand, 0 to 3 percent slopes	2,260	0.7
33B	Ormas loamy sand, 0 to 6 percent slopes	9,730	2.9
34B	Owosso sandy loam, 2 to 6 percent slopes	1,535	0.5
36	Pits-Aquents complex	455	0.1
37	Aquents, sandy and loamy	2,660	0.8
38	Udipsamments, gently sloping	1,050	0.3
43	Corunna fine sandy loam	595	0.2
	Water areas less than 40 acres	1,420	0.4
	Water areas greater than 40 acres	7,093	2.1
	Total	332,243	100.0

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
2B	Kidder fine sandy loam, 2 to 6 percent slopes
4B	Oshtemo sandy loam, 0 to 6 percent slopes
5B	Hillsdale-Riddles fine sandy loams, 2 to 6 percent slopes
6	Gilford sandy loam (where drained)
7B	Hatmaker loam, 1 to 4 percent slopes (where drained)
9A	Matherton sandy loam, 0 to 3 percent slopes (where drained)
10A	Brady sandy loam, 0 to 2 percent slopes
11B	Elmdale fine sandy loam, 2 to 6 percent slopes
12A	Teasdale fine sandy loam, 0 to 3 percent slopes
15B	Locke fine sandy loam, 1 to 4 percent slopes
17	Barry loam (where drained)
19	Barry loam, shaly substratum (where drained)
21A	Bronson sandy loam, 0 to 3 percent slopes
24	Sebewa loam (where drained)
25B	Branch loamy sand, 1 to 4 percent slopes
27A	Fox sandy loam, 0 to 2 percent slopes
27B	Fox sandy loam, 2 to 6 percent slopes
29B	Morley silt loam, 1 to 6 percent slopes
34B	Owosso sandy loam, 2 to 6 percent slopes
43	Corunna fine sandy loam (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability		Corn		Corn silage		Winter wheat		Oats		Soybeans	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
2B---------------- Kidder	IIe	---	115	---	19	---	60	---	80	---	36	---
2C---------------- Kidder	IIIe	---	100	---	16	---	42	---	77	---	34	---
4B---------------- Oshtemo	IIIs	IIe	95	175	16	28	45	---	80	---	30	58
4C---------------- Oshtemo	IIIe	IIIe	90	165	15	26	40	---	75	---	26	55
4E---------------- Oshtemo	VIe	---	---	---	---	---	---	---	---	---	---	---
5B---------------- Hillsdale-Riddles	IIe	IIe	103	170	16	25	43	---	---	---	37	55
5C---------------- Hillsdale-Riddles	IIIe	---	90	---	16	---	38	---	---	---	34	---
6----------------- Gilford	IIIw	---	90	---	16	---	45	---	55	---	30	---
7B---------------- Hatmaker	IIw	---	115	---	18	---	60	---	95	---	40	---
8----------------- Cohoctah	Vw	---	---	---	---	---	---	---	---	---	---	---
9A---------------- Matherton	IIw	---	105	---	17	---	45	---	80	---	36	---
10A--------------- Brady	IIw	---	105	---	16	---	50	---	90	---	32	---
11B--------------- Elmdale	IIe	IIe	95	170	16	25	40	---	65	---	32	55
12A--------------- Teasdale	IIw	---	105	---	17	---	50	---	90	---	33	---
14---------------- Houghton	Vw	---	---	---	---	---	---	---	---	---	---	---
15B--------------- Locke	IIe	---	95	---	16	---	42	---	75	---	32	---
17---------------- Barry	IIw	---	110	---	17	---	55	---	95	---	35	---
18B--------------- Spinks	IIIs	IIIe	75	165	13	24	30	---	60	---	27	50
19---------------- Barry	IIw	---	110	---	17	---	55	---	95	---	35	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Corn silage		Winter wheat		Oats		Soybeans	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
20---------------- Adrian	Vw	---	---	---	---	---	---	---	---	---	---	---
21A--------------- Bronson	IIs	IIs	75	170	13	27	35	---	60	---	28	55
22---------------- Palms	Vw	---	---	---	---	---	---	---	---	---	---	---
24---------------- Sebewa	IIw	---	105	---	17	---	50	---	90	---	36	---
25B--------------- Branch	IIIs	---	75	---	13	---	---	---	60	---	28	---
26---------------- Edwards	Vw	---	---	---	---	---	---	---	---	---	---	---
27A--------------- Fox	IIs	IIs	95	180	15	28	45	---	75	---	32	58
27B--------------- Fox	IIe	IIe	95	180	15	28	42	---	75	---	30	58
27C--------------- Fox	IIIe	IIIe	85	165	14	28	38	---	65	---	28	55
29B--------------- Morley	IIe	---	102	---	---	---	47	---	63	---	35	---
29C--------------- Morley	IIIe	---	100	---	---	---	46	---	62	---	34	---
30B--------------- Leoni	IIIs	IIIe	70	150	12	25	30	50	50	---	28	---
32A--------------- Thetford	IIIw	IIIw	80	140	12	22	35	---	60	---	30	---
33B--------------- Ormas	IIIs	IIIe	75	165	---	---	30	---	---	---	27	50
34B--------------- Owosso	IIe	---	90	---	---	---	40	---	---	---	32	---
36. Pits-Aquents												
37. Aquents												
38. Udipsamments												
43---------------- Corunna	IIw	---	120	---	18	---	65	---	100	---	40	---

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	232,965	124,615	84,285	24,065
III	50,225	7,095	5,865	37,265
IV	---	---	---	---
V	35,620	---	35,620	---
VI	755	755	---	---
VII	---	---	---	---
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume	Trees to plant
								cf/ac/yr	
2B, 2C---------- Kidder	3A	Slight	Slight	Slight	Slight	Northern red oak---- White ash----------- White oak----------- Shagbark hickory----	65 --- --- ---	48 --- --- ---	Eastern white pine, red pine, white spruce.
4B, 4C---------- Oshtemo	3A	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- American basswood--- Sugar maple---------	66 --- 66 61	48 --- 41 38	Eastern white pine, red pine, white spruce, Norway spruce, imperial Carolina poplar.
4E-------------- Oshtemo	3R	Moderate	Moderate	Slight	Slight	Northern red oak---- White oak----------- American basswood--- Sugar maple---------	66 --- 66 61	48 --- --- 38	Eastern white pine, red pine, white spruce, Norway spruce, imperial Carolina poplar.
5B*, 5C*: Hillsdale-------	3A	Slight	Slight	Slight	Slight	Northern red oak---- White ash----------- Sugar maple--------- Black cherry-------- American basswood--- Yellow-poplar-------	66 --- --- --- --- ---	48 --- --- --- --- ---	Black walnut, eastern white pine, white spruce, red pine, yellow-poplar, imperial Carolina poplar.
Riddles---------	4A	Slight	Slight	Slight	Slight	Northern red oak---- Red maple----------- White ash----------- Green ash----------- Black walnut-------- Yellow-poplar-------	75 75 75 75 --- ---	57 47 78 78 --- ---	Black walnut, eastern cottonwood, red pine, white spruce.
6--------------- Gilford	2W	Slight	Severe	Severe	Severe	Red maple----------- Silver maple-------- American basswood--- Bur oak------------- White ash----------- Swamp white oak-----	56 --- --- --- --- ---	36 --- --- --- --- ---	Eastern white pine, white spruce.
7B-------------- Hatmaker	3W	Slight	Moderate	Slight	Moderate	Northern red oak---- Red maple----------- White ash----------- Quaking aspen------- Eastern cottonwood-- American basswood---	65 --- --- --- --- ---	48 --- --- --- --- ---	Imperial Carolina poplar, eastern white pine, Norway spruce.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume	Trees to plant
								cf/ac/yr	
8----- Cohoctah	2W	Slight	Severe	Severe	Severe	Silver maple-----	80	34	Eastern white pine, white spruce, northern white-cedar.
						Red maple-----	56	36	
						Eastern cottonwood-----	---	---	
						White ash-----	---	---	
						Swamp white oak-----	---	---	
						American sycamore-----	---	---	
9A----- Matherton	3W	Slight	Moderate	Slight	Moderate	Northern red oak-----	62	45	White spruce, Norway spruce, eastern white pine.
						Swamp white oak-----	---	---	
						White oak-----	---	---	
						White ash-----	---	---	
						American basswood-----	---	---	
						Red maple-----	---	---	
10A----- Brady	3W	Slight	Moderate	Slight	Moderate	Red maple-----	61	38	Imperial Carolina poplar, Norway spruce, eastern white pine.
						White ash-----	---	---	
						Quaking aspen-----	---	---	
						Silver maple-----	---	---	
						Bitternut hickory-----	---	---	
						Swamp white oak-----	---	---	
						American basswood-----	61	38	
11B----- Elmdale	4A	Slight	Slight	Slight	Slight	Northern red oak-----	70	52	Black walnut, yellow-poplar.
						White oak-----	---	---	
						Black walnut-----	---	---	
						Black cherry-----	---	---	
						Yellow-poplar-----	---	---	
						Sugar maple-----	---	---	
						American basswood-----	---	---	
						White ash-----	---	---	
12A----- Teasdale	3W	Slight	Moderate	Slight	Moderate	Northern red oak-----	66	48	White spruce, eastern white pine, Norway spruce, imperial Carolina poplar.
						Red maple-----	66	41	
						White ash-----	66	65	
						Eastern cottonwood-----	---	---	
						American basswood-----	---	---	
						Northern pin oak-----	---	---	
14----- Houghton	2W	Slight	Severe	Severe	Severe	Silver maple-----	82	36	
						Red maple-----	56	36	
						White ash-----	56	40	
						Quaking aspen-----	60	64	
						Tamarack-----	45	35	
						Green ash-----	---	---	
						Northern white-cedar	37	55	
15B----- Locke	3W	Slight	Moderate	Slight	Moderate	Northern red oak-----	66	48	White spruce, eastern white pine, Norway spruce, imperial Carolina poplar.
						White oak-----	---	---	
						White ash-----	---	---	
						Red maple-----	---	---	
						American basswood-----	---	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume	Trees to plant
								cf/ac/yr	
17-------------- Barry	2W	Slight	Severe	Severe	Severe	Red maple-----------	56	36	Eastern white pine, white spruce.
						White ash-----------	---	---	
						Eastern cottonwood--	---	---	
						Silver maple--------	---	---	
						Swamp white oak-----	---	---	
						American sycamore---	---	---	
						Bitternut hickory---	---	---	
						Pin oak-------------	---	---	
18B------------- Spinks	3S	Slight	Slight	Moderate	Slight	Northern red oak----	66	48	Red pine, eastern white pine, imperial Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
19-------------- Barry	2W	Slight	Severe	Moderate	Moderate	Red maple-----------	56	36	Eastern white pine, white spruce.
						White ash-----------	---	---	
						Eastern cottonwood--	---	---	
						Silver maple--------	---	---	
						Swamp white oak-----	---	---	
						American sycamore---	---	---	
						Bitternut hickory---	---	---	
						Pin oak-------------	---	---	
20-------------- Adrian	2W	Slight	Severe	Severe	Severe	Silver maple--------	78	32	
						Red maple-----------	53	34	
						White ash-----------	69	73	
						Quaking aspen-------	60	64	
						Tamarack------------	45	35	
						Green ash-----------	69	73	
21A------------- Bronson	3A	Slight	Slight	Slight	Slight	Northern red oak----	66	48	Eastern white pine, red pine, imperial Carolina poplar, black walnut.
						White oak-----------	66	48	
						Sugar maple---------	61	38	
						American beech------	---	---	
						American basswood---	---	---	
						Shagbark hickory----	---	---	
						Black walnut--------	---	---	
22-------------- Palms	2W	Slight	Severe	Severe	Severe	Red maple-----------	55	35	
						Silver maple--------	---	---	
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Northern white-cedar	---	---	
						Tamarack------------	---	---	
						Black ash-----------	---	---	
24-------------- Sebewa	3W	Slight	Severe	Severe	Severe	Red maple-----------	66	41	White spruce, eastern white pine, Norway spruce, white ash, imperial Carolina poplar.
						White ash-----------	69	73	
						American basswood---	---	---	
						Swamp white oak-----	---	---	
						Northern red oak----	---	---	
25B------------- Branch	3S	Slight	Slight	Moderate	Slight	Northern red oak----	65	48	Eastern white pine, red pine, imperial Carolina poplar, black walnut.
						White oak-----------	---	---	
						Sugar maple---------	---	---	
						American beech------	---	---	
						American basswood---	---	---	
						Shagbark hickory----	---	---	
						Black walnut--------	---	---	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume	Trees to plant
								cf/ac/yr	
26------------- Edwards	2W	Slight	Severe	Severe	Severe	Red maple-----------	56	36	
						White ash-----------	---	---	
						Green ash-----------	---	---	
						Tamarack------------	---	---	
						Swamp white oak-----	---	---	
						Silver maple--------	---	---	
27A, 27B, 27C--- Fox	3A	Slight	Slight	Slight	Slight	Northern red oak----	65	48	Red pine, eastern white pine, white spruce, Norway spruce.
						White oak-----------	---	---	
						Sugar maple---------	---	---	
29B, 29C-------- Morley	4A	Slight	Slight	Slight	Slight	White oak-----------	70	52	White oak, black walnut, green ash, eastern white pine, Norway spruce, red pine, white spruce.
						Northern red oak----	70	52	
						Black walnut--------	---	---	
						Shagbark hickory----	---	---	
30B------------- Leoni	3A	Slight	Slight	Slight	Slight	Northern red oak----	65	48	Red pine, eastern white pine, black walnut.
						White oak-----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						White ash-----------	---	---	
						Black walnut--------	---	---	
						Black cherry--------	---	---	
32A------------- Thetford	3W	Slight	Moderate	Slight	Moderate	Red maple-----------	65	40	White spruce, Norway spruce, eastern white pine, imperial Carolina poplar.
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Eastern cottonwood--	---	---	
						Northern red oak----	---	---	
						Swamp white oak-----	---	---	
						Bitternut hickory---	---	---	
33B------------- Ormas	3S	Slight	Slight	Moderate	Slight	Black oak-----------	65	48	Black walnut, Norway spruce, red pine, eastern white pine, yellow-poplar, white oak.
						White oak-----------	66	48	
						Bigtooth aspen------	75	87	
						Black cherry--------	---	---	
						Yellow-poplar-------	---	---	
34B------------- Owosso	4A	Slight	Slight	Slight	Slight	White oak-----------	80	62	Eastern white pine, red pine, yellow-poplar, black walnut.
						Yellow-poplar-------	---	---	
						American beech------	---	---	
43-------------- Corunna	2W	Slight	Severe	Moderate	Moderate	Silver maple--------	82	36	Eastern white pine, white spruce.
						Red maple-----------	56	36	
						White ash-----------	---	---	
						American basswood---	---	---	
						American sycamore---	---	---	
						Pin oak-------------	---	---	
						Swamp white oak-----	---	---	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
2B, 2C------------ Kidder	---	Northern white-cedar, lilac, gray dogwood, Amur maple, American cranberrybush.	White spruce, Black Hills spruce, Norway spruce.	Eastern white pine, white ash, red maple, red pine.	Imperial Carolina poplar.
4B, 4C, 4E-------- Oshtemo	---	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, American cranberrybush, nannyberry viburnum.	Red pine, jack pine, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
5B*, 5C*:					
Hillsdale--------	---	Tatarian honeysuckle, lilac, Siberian crabapple, Amur privet, autumn-olive.	White spruce------	Eastern white pine, red pine, Norway spruce.	Imperial Carolina poplar.
Riddles----------	---	Amur privet, Amur honeysuckle, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
6---------------- Gilford	---	Silky dogwood, American cranberrybush, Amur privet, lilac, nannyberry viburnum.	Northern white-cedar, white spruce, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
7B--------------- Hatmaker	Vanhoutte spirea	Silky dogwood, Tatarian honeysuckle, American cranberrybush, Amur privet.	Northern white-cedar, white spruce, Manchurian crabapple.	Eastern white pine, Norway spruce.	Golden willow, imperial Carolina poplar.
8. Cohoctah					
9A--------------- Matherton	Vanhoutte spirea	Silky dogwood, nannyberry viburnum, Amur privet, Amur maple, American cranberrybush.	Northern white-cedar, white spruce, Manchurian crabapple.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
10A. Brady	---	Silky dogwood, lilac, nannyberry viburnum, Amur maple, American cranberrybush.	White spruce, northern white-cedar.	Norway spruce, eastern white pine, red pine, green ash.	Imperial Carolina poplar.
11B. Elmdale	Silky dogwood	Lilac, autumn-olive, Tatarian honeysuckle, Amur privet.	Red pine, white spruce.	Green ash, eastern white pine, Norway spruce.	Imperial Carolina poplar.
12A. Teasdale	---	American cranberrybush, Amur privet, silky dogwood, Tatarian honeysuckle, nannyberry viburnum.	White spruce, northern white-cedar, Manchurian crabapple.	Eastern white pine, Norway spruce.	Imperial Carolina poplar, golden willow.
14. Houghton	---	Silky dogwood, late lilac, Amur privet, common ninebark, nannyberry viburnum.	Japanese tree lilac, northern white-cedar.	Black willow, green ash, Siberian crabapple.	Imperial Carolina poplar.
15B. Locke	Vanhoutte spirea	Silky dogwood, Amur privet, American cranberrybush, nannyberry viburnum.	Northern white-cedar, white spruce, Manchurian crabapple.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
17. Barry	Vanhoutte spirea	Silky dogwood, American cranberrybush, Amur privet.	White spruce, Manchurian crabapple, northern white-cedar.	Norway spruce, green ash, white ash, red maple.	Imperial Carolina poplar.
18B. Spinks	Manyflower cotoneaster.	American cranberrybush, silky dogwood, eastern redcedar, lilac, Siberian peashrub.	Red pine, white spruce, jack pine.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
19. Barry	Vanhoutte spirea	Silky dogwood, American cranberrybush, Amur privet.	White spruce, Manchurian crabapple, northern white-cedar.	Norway spruce, green ash, white ash, red maple.	Imperial Carolina poplar.
20. Adrian					
21A. Bronson	---	Amur privet, silky dogwood, lilac, common ninebark, Siberian crabapple, nannyberry viburnum.	White spruce	Eastern white pine, red pine, Norway spruce, green ash.	Imperial Carolina poplar.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
22. Palms					
24 Sebewa	---	Silky dogwood, lilac, Amur privet, American cranberrybush, nannyberry viburnum.	White spruce, northern white-cedar, Manchurian crabapple.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
25B Branch	Manyflower cotoneaster.	Green ash, nannyberry viburnum, silky dogwood, lilac, common ninebark.	White spruce	Eastern white pine, red pine, Norway spruce, red maple.	Imperial Carolina poplar.
26 Edwards	---	Amur privet, nannyberry viburnum, American cranberrybush, silky dogwood, common ninebark, Amur maple.	Manchurian crabapple, northern white-cedar.	White spruce, green ash, black willow.	---
27A, 27B, 27C Fox	Manyflower cotoneaster.	Siberian peashrub, eastern redcedar, lilac, Amur maple, American cranberrybush, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
29B, 29C Morley	---	Eastern redcedar, lilac, Siberian peashrub, northern white-cedar.	White spruce, Siberian crabapple.	Eastern white pine, red maple, green ash, white ash.	---
30B Leoni	---	Siberian peashrub, Amur maple, Amur privet, nannyberry viburnum, lilac, Roselow sargent crabapple, silky dogwood.	Siberian crabapple	Jack pine, red pine, eastern white pine, Norway spruce.	Imperial Carolina poplar.
32A Thetford	---	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	White spruce, northern white-cedar.	Norway spruce, eastern white pine, red maple, green ash.	Imperial Carolina poplar.
33B Ormas	Manyflower cotoneaster.	Lilac, silky dogwood, eastern redcedar, American cranberrybush, Siberian peashrub.	Red pine, jack pine, white spruce.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
34B---------------- Owosso	---	Amur honeysuckle, Amur privet, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
36*: Pits.					
Aquents.					
37. Aquents					
38. Udipsamments					
43---------------- Corunna	---	Silky dogwood, American cranberrybush, lilac, nannyberry viburnum, Amur privet.	Northern white-cedar, Manchurian crabapple, white spruce.	Green ash, eastern white pine, Norway spruce.	Imperial Carolina poplar.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
2B Kidder	Slight	Slight	Moderate: small stones.	Slight	Slight.
2C Kidder	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
4B Oshtemo	Slight	Slight	Moderate: small stones.	Slight	Slight.
4C Oshtemo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
4E Oshtemo	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
5B*:					
Hillsdale	Slight	Slight	Moderate: slope.	Slight	Slight.
Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
5C*:					
Hillsdale	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
6 Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
7B Hatmaker	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
8 Cohoctah	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: flooding, wetness.
9A Matherton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
10A Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
11B Elmdale	Moderate: wetness.	Moderate: wetness.	Moderate: slope, small stones.	Slight	Slight.
12A Teasdale	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
14 Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
15B------------------ Locke	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
17------------------- Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
18B------------------ Spinks	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: droughty.
19------------------- Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
20------------------- Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
21A------------------ Bronson	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
22------------------- Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
24------------------- Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
25B------------------ Branch	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight----------	Moderate: droughty.
26------------------- Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
27A, 27B------------- Fox	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Slight.
27C------------------ Fox	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
29B------------------ Morley	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
29C------------------ Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
30B------------------ Leoni	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: large stones, droughty.
32A------------------ Thetford	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
33B------------------ Ormas	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
34B Owosso	Slight	Slight	Slight	Slight	Slight.
36*: Pits.					
Aquents.					
37. Aquents					
38. Udipsamments					
43 Corunna	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
2B, 2C Kidder	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
4B Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
4C Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
4E Oshtemo	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
5B*:										
Hillsdale	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
5C*:										
Hillsdale	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
6 Gilford	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
7B Hatmaker	Fair	Good	Good	Good	Good	Fair	Very poor.	Good	Good	Poor.
8 Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
9A Matherton	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
10A Brady	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
11B Elmdale	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
12A Teasdale	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
14 Houghton	Fair	Poor	Poor	Fair	Fair	Good	Good	Poor	Poor	Good.
15B Locke	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
17 Barry	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
18B Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
19 Barry	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
20 Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
21A Bronson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
22 Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
24 Sebewa	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
25B Branch	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
26 Edwards	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Poor	Fair	Good.
27A, 27B, 27C Fox	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
29B Morley	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
29C Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
30B Leoni	Poor	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
32A Thetford	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
33B Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
34B Owosso	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
36*:										
Pits.										
Aquents.										
37. Aquents										
38. Udipsamments										
43 Corunna	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2B Kidder	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: frost action, low strength.	Slight.
2C Kidder	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, low strength.	Moderate: slope.
4B Oshtemo	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
4C Oshtemo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
4E Oshtemo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
5B*:						
Hillsdale	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Riddles	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
5C*:						
Hillsdale	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
6 Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
7B Hatmaker	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
8 Cohoctah	Severe: wetness, cutbanks cave.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: wetness, flooding.	Severe: flooding, frost action, wetness.	Severe: flooding, wetness.
9A Matherton	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10A: Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
11B: Elmdale	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Slight.
12A: Teasdale	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
14: Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: slope, low strength, frost action.	Severe: excess humus, ponding.
15B: Locke	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
17: Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
18B: Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
19: Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
20: Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
21A: Bronson	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
22: Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
24: Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
25B: Branch	Severe: cutbanks cave, wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, frost action.	Moderate: droughty.
26: Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
27A: Fox	Severe: cutbanks cave.	Slight	Slight	Moderate: shrink-swell.	Moderate: frost action.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
27B: Fox	Severe: cutbanks cave.	Slight	Slight	Moderate: shrink-swell, slope.	Moderate: frost action.	Slight.
27C: Fox	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
29B: Morley	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
29C: Morley	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
30B: Leoni	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: large stones, droughty.
32A: Thetford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
33B: Ormas	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
34B: Owosso	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
36*: Pits.						
Aquents.						
37. Aquents						
38. Udipsamments						
43: Corunna	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2B Kidder	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
2C Kidder	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
4B Oshtemo	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
4C Oshtemo	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
4E Oshtemo	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
5B*:					
Hillsdale	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Riddles	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
5C*:					
Hillsdale	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Riddles	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
6 Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
7B Hatmaker	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
8 Cohoctah	Severe: wetness, flooding, poor filter.	Severe: wetness, flooding, seepage.	Severe: wetness, flooding, seepage.	Severe: wetness, flooding, seepage.	Poor: wetness, thin layer.
9A Matherton	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10A: Brady	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
11B: Elmdale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too sandy, wetness.
12A: Teasdale	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
14: Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
15B: Locke	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
17: Barry	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
18B: Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
19: Barry	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
20: Adrian	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
21A: Bronson	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage.
22: Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
24: Sebewa	Severe: poor filter, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: small stones, seepage, too sandy.
25B: Branch	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: thin layer.
26: Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
27A, 27B: Fox	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
27C: Fox	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
29B: Morley	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
29C: Morley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
30B: Leoni	Moderate: large stones.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
32A: Thetford	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
33B: Ormas	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
34B: Owosso	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
36*:					
Pits.					
Aquents.					
37. Aquents					
38. Udipsamments					
43: Corunna	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2B, 2C---------------- Kidder	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
4B, 4C---------------- Oshtemo	Good-----------------	Probable-------------	Probable-------------	Fair: small stones.
4E-------------------- Oshtemo	Fair: slope.	Probable-------------	Probable-------------	Poor: slope.
5B*:				
Hillsdale------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
Riddles--------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Slight.
5C*:				
Hillsdale------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Riddles--------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
6--------------------- Gilford	Poor: wetness.	Probable-------------	Probable-------------	Poor: wetness, area reclaim.
7B-------------------- Hatmaker	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, wetness.
8--------------------- Cohoctah	Poor: wetness.	Probable-------------	Probable-------------	Poor: wetness, area reclaim, small stones.
9A-------------------- Matherton	Fair: wetness.	Probable-------------	Probable-------------	Poor: area reclaim.
10A------------------- Brady	Fair: wetness.	Probable-------------	Probable-------------	Poor: small stones.
11B------------------- Elmdale	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
12A------------------- Teasdale	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
14-------------------- Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
15B------------------- Locke	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
17-------------------- Barry	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
18B------------------- Spinks	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
19-------------------- Barry	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
20-------------------- Adrian	Poor: wetness, low strength.	Probable-------------	Improbable: too sandy.	Poor: wetness, excess humus.
21A------------------- Bronson	Fair: wetness.	Probable-------------	Probable-------------	Poor: small stones.
22-------------------- Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
24-------------------- Sebewa	Poor: wetness.	Probable-------------	Probable-------------	Poor: wetness, small stones, area reclaim.
25B------------------- Branch	Fair: wetness.	Probable-------------	Probable-------------	Fair: too sandy, small stones, area reclaim.
26-------------------- Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
27A, 27B, 27C--------- Fox	Good-----------------	Probable-------------	Probable-------------	Poor: small stones, area reclaim.
29B, 29C-------------- Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
30B------------------- Leoni	Fair: large stones.	Probable-------------	Probable-------------	Poor: large stones, area reclaim.
32A------------------- Thetford	Fair: wetness.	Probable-------------	Improbable: too sandy.	Fair: too sandy, small stones.
33B------------------- Ormas	Good-----------------	Probable-------------	Probable-------------	Fair: too sandy, small stones.
34B------------------- Owosso	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Slight.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
36*:				
Pits.				
Aquents.				
37. Aquents				
38. Udipsamments				
43-------------------- Corunna	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The informatic indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversion
2B----------------- Kidder	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Soil blowin erodes eas
2C----------------- Kidder	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, soil blowi erodes eas
4B----------------- Oshtemo	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Too sandy, soil blowi
4C, 4E------------- Oshtemo	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, too sandy, soil blowi
5B*: Hillsdale---------	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Soil blowin
Riddles----------	Moderate: seepage, slope.	Slight---------	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowin
5C*: Hillsdale---------	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, soil blowi
Riddles----------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowi
6------------------ Gilford	Severe: seepage.	Severe: seepage, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowi
7B----------------- Hatmaker	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Frost action---	Wetness, rooting depth.	Erodes easi wetness.
8------------------ Cohoctah	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, soil blowing.	Wetness, soil blowi

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions
9A: Matherton	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowi
10A: Brady	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness, soil blowing.	Wetness, soil blowi
11B: Elmdale	Moderate: seepage, slope.	Severe: piping.	Severe: cutbanks cave.	Slope, cutbanks cave.	Wetness, soil blowing, slope.	Wetness, soil blowi
12A: Teasdale	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action	Wetness, soil blowing.	Wetness, soil blowi
14: Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowi
15B: Locke	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Frost action	Wetness, soil blowing, rooting depth.	Wetness, soil blowi
17: Barry	Severe: seepage.	Severe: piping, ponding.	Moderate: slow refill.	Ponding, frost action.	Ponding	Ponding
18B: Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowi
19: Barry	Moderate: seepage.	Severe: thin layer, ponding.	Severe: no water.	Ponding, frost action.	Ponding, rooting depth.	Ponding
20: Adrian	Severe: seepage.	Severe: seepage, ponding, excess humus.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing.	Ponding, soil blowi too sandy.
21A: Bronson	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowi
22: Palms	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowi

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--*Continued*

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terrace and diversio
24: Sebewa	Severe: seepage.	Severe: seepage, ponding.	Severe: cutbanks cave.	Frost action, cutbanks cave, ponding.	Ponding	Too sandy, ponding.
25B: Branch	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Favorable	Wetness, droughty, fast intake.	Wetness, soil blow
26: Edwards	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blow
27A: Fox	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing	Too sandy, soil blow
27B: Fox	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Too sandy, soil blow
27C: Fox	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, too sandy soil blow
29B: Morley	Moderate: slope.	Slight	Severe: no water.	Deep to water	Percs slowly, slope.	Erodes eas percs slo
29C: Morley	Severe: slope.	Slight	Severe: no water.	Deep to water	Percs slowly, slope.	Slope, erodes ea percs slo
30B: Leoni	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Droughty, slope, large stones.	Large ston
32A: Thetford	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy soil blow
33B: Ormas	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowi
34B: Owosso	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing	Soil blowi
36*: Pits.						
Aquents.						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversion
37. Aquents						
38. Udipsamments						
43---------------- Corunna	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Erodes easi ponding, too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
2B, 2C----------- Kidder	0-9	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-2, A-4	0-5	75-100	70-100	50-85	20-55	<25	2-7
	9-30	Clay loam, fine sandy loam, loam.	CL, SC	A-6, A-4, A-2	0-5	75-100	70-100	55-95	25-80	20-40	8-25
	30-60	Sandy loam, gravelly sandy loam, fine sandy loam.	SM, GM	A-2, A-4, A-1	3-10	50-90	50-90	30-80	15-50	---	NP
4B, 4C, 4E------- Oshtemo	0-11	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	11-33	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	33-45	Loamy sand, sandy loam, gravelly loamy sand.	SM, SP-SM	A-2	0	85-95	60-95	55-70	10-30	---	NP
	45-60	Stratified loamy sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
5B*, 5C*: Hillsdale-------	0-11	Fine sandy loam	SM, SC, ML, CL	A-2-4, A-4	0-5	95-100	80-100	60-90	20-65	<25	2-10
	11-66	Sandy loam, fine sandy loam, loam.	SM, SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0-5	95-100	80-100	65-85	30-50	20-30	2-12
	66-70	Sandy loam, loamy sand.	SM, SC, SM-SC	A-2-4, A-4	0-5	95-100	80-100	55-80	25-40	<22	3-8
Riddles---------	0-11	Fine sandy loam	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	11-36	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	36-54	Clay loam, fine sandy loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	54-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
6---------------- Gilford	0-14	Sandy loam-------	SC, SM-SC, SM	A-4, A-2-4	0	95-100	90-100	60-70	30-40	20-30	2-10
	14-33	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	25-35	20-30	NP-8
	33-47	Coarse sand, sand, loamy sand.	SM, SP, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	18-60	3-18	---	NP
	47-60	Gravelly sand, gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0-15	40-85	35-80	20-50	3-10	---	NP
7B--------------- Hatmaker	0-15	Loam-------------	CL, CL-ML	A-4, A-6	0-2	95-100	95-100	85-95	60-75	20-35	4-15
	15-39	Silty clay loam, silt loam, shaly silty clay loam.	CL, SC	A-4, A-6	2-10	75-95	65-95	65-95	45-95	25-40	7-20
	39-60	Silt loam, silty clay loam, shaly silt loam.	CL, SC	A-4, A-6	2-10	75-95	65-95	65-95	45-95	25-40	7-20

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
8---------------- Cohoctah	0-11	Sandy loam--------	ML, SM	A-4, A-2	0	100	100	65-95	30-75	20-30	NP-6
	11-37	Loam, sandy loam, gravelly sandy loam.	ML, SM, CL, SC	A-4, A-2	0	95-100	65-100	65-90	30-70	20-30	NP-10
	37-60	Sand, gravelly coarse sand, very gravelly sand.	SP-SM, SP, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-90	35-85	30-60	0-10	---	NP
9A--------------- Matherton	0-9	Sandy loam--------	SM	A-2, A-4	0-5	90-100	80-100	50-70	25-40	<20	NP-4
	9-27	Clay loam, gravelly clay loam, loam.	SC, CL, CL-ML, SM-SC	A-6, A-4	0-5	90-100	65-95	50-85	35-70	25-40	5-20
	27-60	Gravelly sand, sand.	GP, SP, SP-SM, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-90	30-55	0-10	---	NP
10A-------------- Brady	0-9	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	9-29	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	75-95	60-80	25-45	15-35	NP-16
	29-60	Loamy sand, sandy loam.	SM	A-2	0-5	95-100	75-95	55-70	15-35	---	NP
	60-70	Gravelly sand, coarse sand, gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-75	35-70	20-55	0-10	---	NP
11B-------------- Elmdale	0-9	Fine sandy loam	SM, SM-SC	A-2-4, A-4, A-1-b	0-10	90-100	85-100	45-70	15-40	<25	2-7
	9-54	Fine sandy loam, sandy loam, loamy fine sand.	SM, CL, SC, ML	A-2, A-4, A-6	0-10	90-100	85-100	55-95	25-70	14-30	2-18
	54-60	Sandy loam, fine sandy loam.	SM, SM-SC, SC	A-2-4, A-4	0-5	95-100	95-100	50-70	20-40	<25	NP-8
12A-------------- Teasdale	0-18	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0-5	95-100	95-100	55-95	25-50	<25	2-8
	18-57	Sandy loam, fine sandy loam, gravelly sandy clay loam.	ML, CL, SM, SC	A-2-4, A-2-6, A-4, A-6	0-8	85-100	80-100	50-85	25-70	20-35	2-15
	57-60	Sandy loam, loamy sand, fine sandy loam.	SM, SM-SC, SC	A-2-4, A-4	0-5	85-100	85-100	55-70	15-40	<25	NP-8
14--------------- Houghton	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
15B-------------- Locke	0-9	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0-7	95-100	80-95	60-90	25-60	<30	3-9
	9-31	Sandy clay loam, sandy loam, loam.	SC, CL	A-6	0-7	95-100	80-95	65-85	35-55	20-30	10-15
	31-60	Sandy loam--------	SM, SM-SC, ML, CL-ML	A-2-4, A-4	0-7	95-100	75-95	60-85	30-55	<30	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17---------------- Barry	0-12	Loam-------------	ML, CL, CL-ML	A-4	0-3	90-100	80-100	80-100	55-90	20-30	NP-8
	12-38	Loam, clay loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-3	90-100	80-100	80-90	45-75	18-28	4-14
	38-60	Sandy loam, fine sandy loam, loam.	SM, SM-SC	A-2, A-4	0-3	90-100	80-100	35-70	30-40	<20	NP-5
18B--------------- Spinks	0-20	Loamy fine sand	SM	A-2-4	0	100	80-100	50-90	15-30	---	NP
	20-52	Stratified fine sand to loamy fine sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
	52-60	Fine sand, sand	SP-SM, SM	A-2-4, A-3	0	100	80-100	50-90	5-25	---	NP
19---------------- Barry	0-12	Loam-------------	ML, CL, CL-ML	A-4	0-3	90-100	80-100	80-100	55-90	20-30	NP-8
	12-38	Loam, clay loam	CL	A-4, A-6	0-3	90-100	80-100	80-95	55-80	25-40	9-20
	38-60	Shaly loam, very shaly loam, shaly silt loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	3-10	75-85	65-85	60-80	45-75	20-35	5-15
20---------------- Adrian	0-31	Sapric material	PT	A-8	---	---	---	---	---	---	---
	31-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
21A--------------- Bronson	0-13	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	65-75	20-40	<25	NP-5
	13-34	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	60-95	60-85	25-45	<30	NP-15
	34-52	Loamy sand, gravelly loamy sand.	SM, SP-SM	A-2	0-5	85-95	60-95	55-70	10-15	---	NP
	52-60	Sand and gravel	SP, GP, SP-SM, GP-GM	A-1, A-2, A-3	0-10	40-90	35-85	20-60	0-10	---	NP
22---------------- Palms	0-31	Sapric material	PT	A-8	---	---	---	---	---	---	---
	31-60	Clay loam, silty clay loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
24---------------- Sebewa	0-12	Loam-------------	CL, CL-ML, ML	A-4, A-6	0	95-100	80-100	75-95	50-90	15-30	3-15
	12-31	Sandy clay loam, loam, gravelly clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	31-60	Gravelly sand, sand.	SP, SP-SM, GP, GP-GM	A-1	0-5	40-90	35-80	20-45	0-10	---	NP
25B--------------- Branch	0-28	Loamy sand--------	SM	A-2-4	0	95-100	95-100	50-75	15-30	---	NP
	28-57	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2-4, A-4, A-6, A-2-6	0	95-100	60-95	60-85	25-45	<30	NP-15
	57-60	Gravelly sand----	SP, SP-SM, GP, GP-GM	A-3, A-1-b, A-2-4	0-5	50-80	40-80	30-55	3-12	---	NP
26---------------- Edwards	0-24	Sapric material	PT	A-8	0	---	---	---	---	---	---
	24-60	Marl-------------	---	---	0	100	95-100	80-90	60-80	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
27A, 27B, 27C---- Fox	0-16	Sandy loam-------	SM, SM-SC	A-4, A-2, A-1	0	70-100	65-100	45-80	20-50	<25	2-7
	16-36	Gravelly clay loam, gravelly sandy loam, sandy clay loam.	CL, SC, GC	A-2, A-6, A-7	0-5	65-100	55-100	30-100	15-80	22-45	10-25
	36-60	Sand and gravel, sand, coarse sand.	SP, GP, SP-SM, GP-GM	A-1, A-2, A-3	0-10	30-100	30-100	10-95	2-10	---	NP
29B, 29C--------- Morley	0-13	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	13-18	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	18-27	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
	27-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
30B-------------- Leoni	0-9	Gravelly sandy loam.	SM	A-2, A-4	1-20	85-95	75-90	60-80	30-50	<30	NP-7
	9-40	Cobbly clay loam, very gravelly sandy clay loam, gravelly sandy loam.	CL, SC, GC	A-6, A-4	5-30	70-85	60-85	50-70	40-60	25-40	8-20
	40-60	Very gravelly sand, gravelly loamy sand, cobbly sandy loam.	SM, SP-SM, SC, SM-SC	A-1, A-2, A-4	5-35	65-85	40-80	35-50	5-40	<22	NP-8
32A-------------- Thetford	0-14	Loamy fine sand	SM	A-2, A-4	0	95-100	90-100	70-85	20-45	<20	NP-4
	14-42	Loamy sand, fine sandy loam, fine sand.	SM	A-2, A-4	0	95-100	90-100	60-80	20-40	<20	NP-4
	42-80	Very fine sand, fine sand, sand.	SM, SP, SP-SM	A-2, A-4, A-3	0	95-100	70-100	50-85	0-45	<20	NP-4
33B-------------- Ormas	0-29	Loamy sand-------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	29-51	Sandy loam, fine sandy loam.	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	51-60	Gravelly sand, very gravelly sand, coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
34B-------------- Owosso	0-10	Sandy loam-------	SM, SM-SC, SC	A-2-4, A-4	0-5	95-100	85-100	50-85	25-50	15-29	NP-10
	10-30	Fine sandy loam, sandy loam, loam.	SM, SM-SC, SC	A-2, A-4, A-6	0-5	95-100	85-100	50-85	25-50	15-35	3-15
	30-60	Loam, clay loam, sandy clay loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0	80-95	80-95	70-90	35-70	25-40	6-20
36*: Pits.											
Aquents.											
37. Aquents											

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
38. Udipsamments											
43---------------- Corunna	0-11	Fine sandy loam	SM, ML, SC, CL	A-2, A-4	0-5	95-100	95-100	65-85	25-70	<30	NP-10
	11-36	Loam, loamy sand, sand, fine sandy loam.	SM, SC, SM-SC	A-4, A-2	0-5	95-100	95-100	50-75	15-40	<30	NP-10
	36-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7	0	100	95-100	90-100	70-90	25-50	11-25

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
2B, 2C----------- Kidder	0-9	5-15	1.40-1.70	0.6-2.0	0.10-0.18	6.1-7.8	Low-----------	0.24	5	3	1-2
	9-30	20-30	1.50-1.65	0.6-2.0	0.11-0.19	5.6-7.8	Moderate-----	0.37			
	30-60	6-15	1.55-1.85	2.0-6.0	0.06-0.15	7.4-8.4	Low-----------	0.20			
4B, 4C, 4E------- Oshtemo	0-11	2-10	1.20-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	11-33	10-18	1.20-1.60	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	33-45	5-15	1.20-1.60	2.0-6.0	0.06-0.10	5.1-7.3	Low-----------	0.17			
	45-60	0-15	1.20-1.50	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
5B*, 5C*:											
Hillsdale-------	0-11	2-15	1.10-1.60	0.6-6.0	0.13-0.22	5.1-6.5	Low-----------	0.24	5	3	1-3
	11-66	10-18	1.25-1.70	0.6-6.0	0.12-0.18	4.5-6.5	Low-----------	0.24			
	66-70	0-15	1.30-1.95	2.0-6.0	0.08-0.13	7.9-8.4	Low-----------	0.24			
Riddles---------	0-11	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low-----------	0.24	5	3	.5-2
	11-36	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate-----	0.32			
	36-54	20-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.32			
	54-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low-----------	0.32			
6---------------- Gilford	0-14	10-20	1.50-1.70	2.0-6.0	0.16-0.18	5.6-7.3	Low-----------	0.20	4	3	2-4
	14-33	8-17	1.60-1.80	2.0-6.0	0.10-0.14	5.6-7.3	Low-----------	0.20			
	33-47	3-12	1.70-1.90	6.0-20	0.05-0.08	6.6-8.4	Low-----------	0.15			
	47-60	1-5	1.70-1.90	>20	0.02-0.04	6.6-8.4	Low-----------	0.10			
7B--------------- Hatmaker	0-15	15-25	1.10-1.60	2.0-6.0	0.18-0.22	6.1-7.3	Low-----------	0.32	5	5	1-2
	15-39	18-35	1.35-1.80	0.2-2.0	0.12-0.20	6.1-8.4	Low-----------	0.43			
	39-60	18-35	1.40-1.80	0.2-0.6	0.12-0.20	7.9-8.4	Low-----------	0.43			
8---------------- Cohoctah	0-11	5-20	1.20-1.60	2.0-6.0	0.13-0.22	6.1-7.8	Low-----------	0.28	5	3	1-4
	11-37	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			
	37-60	5-10	1.40-1.55	>20	0.02-0.07	7.9-8.4	Low-----------	0.10			
9A--------------- Matherton	0-9	10-20	1.30-1.65	2.0-6.0	0.13-0.15	5.6-7.3	Low-----------	0.20	4	3	2-4
	9-27	20-35	1.40-1.70	0.6-2.0	0.16-0.18	5.6-7.3	Low-----------	0.28			
	27-60	0-10	1.50-1.65	>6.0	0.02-0.04	7.4-8.4	Low-----------	0.10			
10A-------------- Brady	0-9	2-15	1.25-1.40	2.0-6.0	0.12-0.15	5.6-7.3	Low-----------	0.20	5	3	1-4
	9-29	5-22	1.35-1.45	2.0-6.0	0.12-0.17	5.1-6.5	Low-----------	0.20			
	29-60	5-20	1.25-1.50	2.0-6.0	0.08-0.10	5.1-7.3	Low-----------	0.20			
	60-70	0-10	1.25-1.50	>20	0.02-0.04	6.6-8.4	Low-----------	0.10			
11B-------------- Elmdale	0-9	2-15	1.10-1.65	2.0-6.0	0.12-0.15	5.1-7.3	Low-----------	0.24	5	3	1-3
	9-54	10-18	1.20-1.70	0.6-2.0	0.11-0.17	4.5-7.3	Low-----------	0.24			
	54-60	2-15	1.80-2.00	0.6-2.0	0.10-0.13	6.6-8.4	Low-----------	0.24			
12A-------------- Teasdale	0-18	5-15	1.25-1.75	2.0-6.0	0.12-0.15	5.1-6.5	Low-----------	0.24	5	3	2-3
	18-57	10-18	1.40-1.85	0.6-2.0	0.11-0.17	4.5-7.3	Low-----------	0.24			
	57-60	5-15	1.70-1.95	2.0-6.0	0.08-0.15	6.6-8.4	Low-----------	0.24			
14--------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	4.5-7.8	-------------	----	2	2	>70
15B-------------- Locke	0-9	10-20	1.35-1.65	0.6-6.0	0.16-0.20	5.1-7.3	Low-----------	0.20	5	3	2-4
	9-31	18-25	1.40-1.70	0.6-2.0	0.14-0.18	5.6-7.3	Low-----------	0.32			
	31-60	8-18	1.65-1.80	0.6-2.0	0.12-0.15	7.4-8.4	Low-----------	0.32			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
17---------------- Barry	0-12	8-18	1.60-1.75	0.6-2.0	0.20-0.22	6.1-7.8	Low-----------	0.28	5	5	4-7
	12-38	18-25	1.25-1.85	0.6-2.0	0.14-0.19	6.1-7.8	Low-----------	0.28			
	38-60	5-18	1.80-2.00	2.0-6.0	0.10-0.13	7.4-8.4	Low-----------	0.28			
18B--------------- Spinks	0-20	2-15	1.20-1.60	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	20-52	0-15	1.20-1.50	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
	52-60	0-10	1.20-1.50	6.0-20	0.04-0.06	6.6-8.4	Low-----------	0.17			
19---------------- Barry	0-12	8-18	1.60-1.70	0.6-2.0	0.20-0.22	6.1-7.8	Low-----------	0.28	5	5	4-7
	12-38	18-30	1.45-1.85	0.6-2.0	0.15-0.19	6.1-7.8	Low-----------	0.28			
	38-60	15-27	1.50-1.95	0.2-0.6	0.08-0.16	7.4-8.4	Low-----------	0.28			
20---------------- Adrian	0-31	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	--------------	----	2	2	55-75
	31-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low-----------	----			
21A--------------- Bronson	0-13	2-15	1.14-1.60	2.0-6.0	0.13-0.15	5.1-7.3	Low-----------	0.24	4	3	1-3
	13-34	10-20	1.26-1.59	2.0-6.0	0.12-0.18	5.1-7.3	Low-----------	0.24			
	34-52	0-10	1.26-1.59	2.0-6.0	0.06-0.08	5.1-7.3	Low-----------	0.17			
	52-60	0-5	1.20-1.47	6.0-20	0.02-0.04	7.4-8.4	Low-----------	0.10			
22---------------- Palms	0-31	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	--------------	----	2	2	>75
	31-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----			
24---------------- Sebewa	0-12	10-25	1.10-1.60	0.6-2.0	0.18-0.25	6.1-7.8	Low-----------	0.24	4	5	1-6
	12-31	18-35	1.50-1.80	0.6-2.0	0.15-0.19	6.1-7.8	Low-----------	0.24			
	31-60	0-3	1.55-1.75	6.0-20	0.02-0.04	7.4-8.4	Low-----------	0.10			
25B--------------- Branch	0-28	5-12	1.40-1.60	6.0-20	0.10-0.12	4.5-7.3	Low-----------	0.17	5	2	.5-3
	28-57	10-25	1.25-1.60	2.0-6.0	0.08-0.18	4.5-7.3	Low-----------	0.24			
	57-60	1-8	1.50-1.70	>20	0.02-0.05	7.4-8.4	Low-----------	0.15			
26---------------- Edwards	0-24	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	--------------	----	2	2	55-75
	24-60	---	---	---	---	7.4-8.4	--------------	----			
27A, 27B, 27C---- Fox	0-16	5-15	1.40-1.70	0.6-2.0	0.11-0.18	5.1-7.3	Low-----------	0.24	4	3	1-3
	16-36	18-35	1.55-1.65	0.6-2.0	0.10-0.19	5.1-8.4	Moderate-----	0.32			
	36-60	0-2	1.30-1.80	>6.0	0.02-0.7	7.4-8.4	Low-----------	0.10			
29B, 29C--------- Morley	0-13	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low-----------	0.43	3	6	1-3
	13-18	27-40	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	18-27	27-50	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
	27-60	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
30B--------------- Leoni	0-9	2-18	1.30-1.70	0.6-6.0	0.07-0.15	5.6-7.3	Low-----------	0.10	3	8	1-3
	9-40	18-35	1.30-1.70	0.6-2.0	0.06-0.12	5.1-7.3	Low-----------	0.10			
	40-60	0-18	1.20-1.50	2.0-20	0.01-0.03	7.4-8.4	Low-----------	0.10			
32A--------------- Thetford	0-14	2-15	1.25-1.41	2.0-6.0	0.10-0.13	5.6-7.3	Low-----------	0.17	5	2	1-4
	14-42	8-18	1.35-1.45	2.0-6.0	0.08-0.13	5.6-7.8	Low-----------	0.17			
	42-80	0-10	1.25-1.50	6.0-20	0.05-0.08	7.4-8.4	Low-----------	0.17			
33B--------------- Ormas	0-29	5-12	1.40-1.60	2.0-6.0	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	1-3
	29-51	10-20	1.50-1.70	2.0-6.0	0.12-0.14	5.1-6.5	Low-----------	0.17			
	51-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low-----------	0.15			
34B--------------- Owosso	0-10	10-19	1.40-1.60	0.6-2.0	0.13-0.18	5.1-7.3	Low-----------	0.28	5	3	1-3
	10-30	10-19	1.40-1.60	0.6-2.0	0.12-0.17	5.1-6.5	Low-----------	0.28			
	30-60	20-30	1.45-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Low-----------	0.28			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
36*:											
Pits.											
Aquents.											
37. Aquents											
38. Udipsamments											
43---------------- Corunna	0-11	5-15	1.60-1.70	0.6-6.0	0.14-0.22	6.1-7.8	Low-----------	0.20	4	3	1-2
	11-36	10-18	1.30-1.60	0.6-6.0	0.08-0.14	6.1-7.8	Low-----------	0.20			
	36-60	18-35	1.45-1.70	0.2-0.6	0.16-0.20	7.4-8.4	Moderate------	0.43			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "frequent," "apparent," and "perched" are explained in the te
< means less than; > means more than. Absence of an entry indicates that the feature is not a concern o
estimated]

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Total subsidence	Potentia frost action
					Ft			In	
2B, 2C: Kidder	B	None	---	---	>6.0	---	---	---	Moderate
4B, 4C, 4E: Oshtemo	B	None	---	---	>6.0	---	---	---	Low
5B*, 5C*:									
Hillsdale	B	None	---	---	>6.0	---	---	---	Moderate
Riddles	B	None	---	---	>6.0	---	---	---	Moderate
6: Gilford	B/D	None	---	---	+.5-1.0	Apparent	Dec-May	---	High
7B: Hatmaker	C	None	---	---	0.5-1.5	Perched	Nov-May	---	High
8: Cohoctah	B/D	Frequent	Long	Jan-Dec	0-1.0	Apparent	Sep-May	---	High
9A: Matherton	B	None	---	---	1.0-2.0	Apparent	Nov-May	---	High
10A: Brady	B	None	---	---	1.0-3.0	Apparent	Nov-May	---	High
11B: Elmdale	B	None	---	---	2.0-3.0	Apparent	Nov-Apr	---	Moderate
12A: Teasdale	B	None	---	---	1.0-2.0	Apparent	Nov-May	---	High
14: Houghton	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	55-60	High
15B: Locke	B	None	---	---	1.0-2.0	Apparent	Nov-May	---	High
17: Barry	B/D	None	---	---	+1-1.0	Apparent	Nov-May	---	High
18B: Spinks	A	None	---	---	>6.0	---	---	---	Low
19: Barry	B/D	None	---	---	+1-1.0	Perched	Nov-May	---	High

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Total subsidence	Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months		
					Ft			In	
20----- Adrian	A/D	None-----	---	---	+1-1.0	Apparent	Nov-May	29-33	High-----
21A----- Bronson	B	None-----	---	---	2.0-3.5	Apparent	Nov-May	---	High-----
22----- Palms	A/D	None-----	---	---	+1-1.0	Apparent	Nov-May	25-32	High-----
24----- Sebewa	B/D	None-----	---	---	+1-1.0	Apparent	Sep-May	---	High-----
25B----- Branch	B	None-----	---	---	2.0-3.5	Apparent	Nov-Apr	---	Moderate
26----- Edwards	B/D	None-----	---	---	+1-0.5	Apparent	Sep-Jun	25-30	High-----
27A, 27B, 27C----- Fox	B	None-----	---	---	>6.0	---	---	---	Moderate
29B, 29C----- Morley	C	None-----	---	---	>6.0	---	---	---	Moderate
30B----- Leoni	B	None-----	---	---	>6.0	---	---	---	Low-----
32A----- Thetford	A	None-----	---	---	1.0-2.0	Apparent	Feb-May	---	Moderate
33B----- Ormas	B	None-----	---	---	>6.0	---	---	---	Moderate
34B----- Owosso	B	None-----	---	---	>6.0	---	---	---	Moderate
36*: Pits.									
Aquents.									
37. Aquents									
38. Udipsamments									
43----- Corunna	B/D	None-----	---	---	+1-1.0	Apparent	Nov-May	---	High-----

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Aquents	Loamy and sandy, mixed, mesic Aquents
Barry	Fine-loamy, mixed, mesic Typic Argiaquolls
*Brady	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Branch	Loamy, mixed, mesic Arenic Hapludalfs
*Bronson	Coarse-loamy, mixed, mesic Aquic Hapludalfs
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Corunna	Coarse-loamy, mixed, mesic Typic Haplaquolls
Edwards	Marly, euic, mesic Limnic Medisaprists
Elmdale	Coarse-loamy, mixed, mesic Typic Hapludalfs
Fox	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludalfs
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Hatmaker	Fine-silty, mixed, mesic Aeric Ochraqualfs
Hillsdale	Coarse-loamy, mixed, mesic Typic Hapludalfs
Houghton	Euic, mesic Typic Medisaprists
Kidder	Fine-loamy, mixed, mesic Typic Hapludalfs
Leoni	Loamy-skeletal, mixed, mesic Typic Hapludalfs
Locke	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Matherton	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Udollic Ochraqualfs
Morley	Fine, illitic, mesic Typic Hapludalfs
Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Oshtemo	Coarse-loamy, mixed, mesic Typic Hapludalfs
Owosso	Fine-loamy, mixed, mesic Typic Hapludalfs
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
Teasdale	Coarse-loamy, siliceous, mesic Glossaquic Hapludalfs
Thetford	Sandy, mixed, mesic Psammaquentic Hapludalfs
Udipsamments	Mixed, mesic Udipsamments

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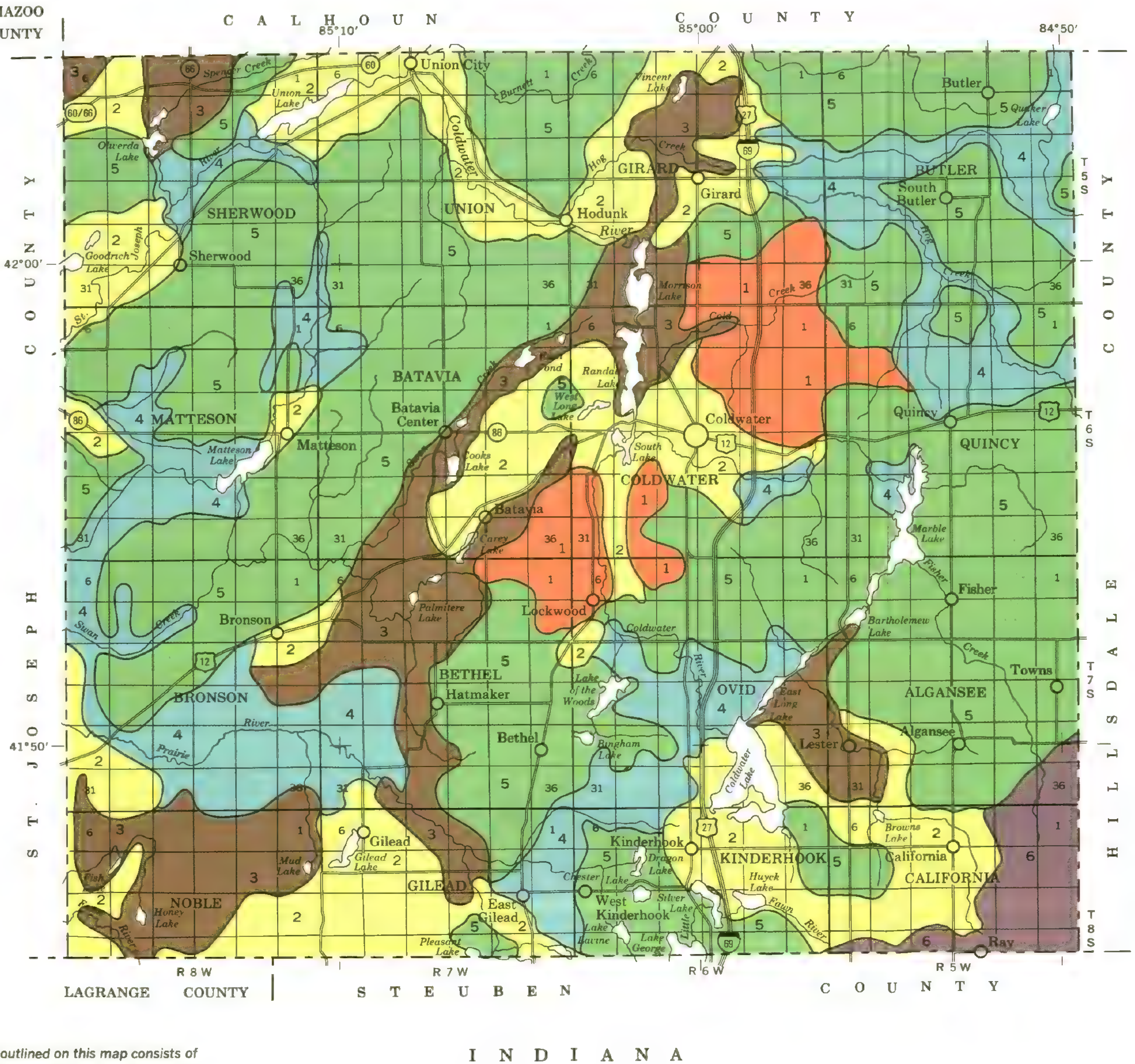


LEGEND*

1 — **HATMAKER-LOCKE-BARRY association:** Level to undulating, somewhat poorly drained and poorly drained, loamy soils on till plains and moraines

2 — **FOX-OSHTEMO-ORMAS association:** Nearly level to moderately steep, well drained, loamy and sandy soils on outwash plains and moraines

3 — **FOX-HOUGHTON-EDWARDS association:** Nearly level to moderately sloping, well drained, loamy soils on outwash plains and moraines and level, very poorly drained, mucky soils in swamps, depressions, and drainageways

4 — **MATHERTON-SEBEWA-BRANCH association:** Level to gently sloping, moderately well drained to poorly drained, loamy and sandy soils on outwash plains and moraines

5 — **LOCKE-BARRY-HILLSDALE association:** Level to moderately sloping, somewhat poorly drained, poorly drained, and well drained, loamy soils on till plains and moraines

6 — **MORLEY-LOCKE-HOUGHTON association:** Nearly level to gently rolling, well drained and somewhat poorly drained, silty and loamy soils on till plains and moraines and level, very poorly drained, mucky soils in swamps and depressions

* The texture terms in the descriptive headings refer to the surface layer of the major soils in each association.

COMPILED 1984

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

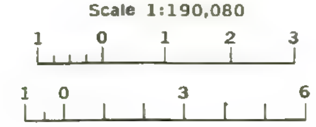
N

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MICHIGAN AGRICULTURAL EXPERIMENT STATION

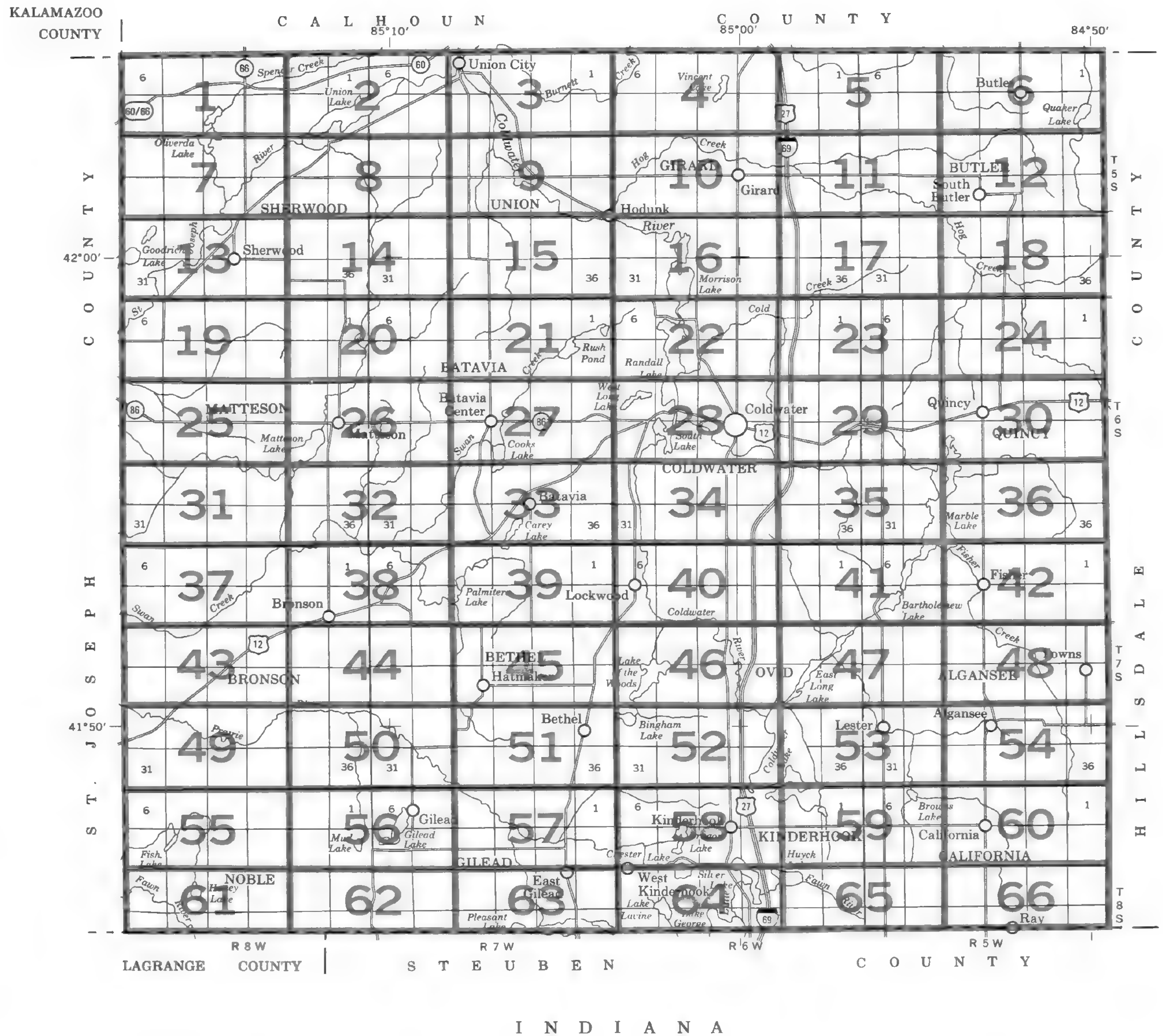
GENERAL SOIL MAP

BRANCH COUNTY, MICHIGAN

Scale 1:190,080



Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:
This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

N

INDEX TO MAP SHEETS

BRANCH COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3

1 0 3 6

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
2B	Kidder fine sandy loam, 2 to 6 percent slopes
2C	Kidder fine sandy loam, 6 to 12 percent slopes
4B	Oshtemo sandy loam, 0 to 6 percent slopes
4C	Oshtemo sandy loam, 6 to 12 percent slopes
4E	Oshtemo sandy loam, 12 to 25 percent slopes
5B	Hillsdale-Riddles fine sandy loams, 2 to 6 percent slopes
5C	Hillsdale-Riddles fine sandy loams, 6 to 12 percent slopes
6	Gilford sandy loam
7B	Hatmaker loam, 1 to 4 percent slopes
8	Cohoctah sandy loam
9A	Matherton sandy loam, 0 to 3 percent slopes
10A	Brady sandy loam, 0 to 2 percent slopes
11B	Elmdale fine sandy loam, 2 to 6 percent slopes
12A	Teasdale fine sandy loam, 0 to 3 percent slopes
14	Houghton muck
15B	Locke fine sandy loam, 1 to 4 percent slopes
17	Barry loam
18B	Spinks loamy fine sand, 0 to 6 percent slopes
19	Barry loam, shaly substratum
20	Adrian muck
21A	Bronson sandy loam, 0 to 3 percent slopes
22	Palms muck
24	Sebewa loam
25B	Branch loamy sand, 1 to 4 percent slopes
26	Edwards muck
27A	Fox sandy loam, 0 to 2 percent slopes
27B	Fox sandy loam, 2 to 6 percent slopes
27C	Fox sandy loam, 6 to 12 percent slopes
29B	Morley silt loam, 1 to 6 percent slopes
29C	Morley silt loam, 6 to 12 percent slopes
30B	Leoni gravelly sandy loam, 0 to 6 percent slopes
32A	Thetford loamy fine sand, 0 to 3 percent slopes
33B	Ormas loamy sand, 0 to 6 percent slopes
34B	Owosso sandy loam, 2 to 6 percent slopes
36	Pits-Aquents complex
37	Aquents, sandy and loamy
38	Udipsamments, gently sloping
43	Corunna fine sandy loam

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label) — Hedley Airstrip

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- Other — Named

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 4B 15B

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

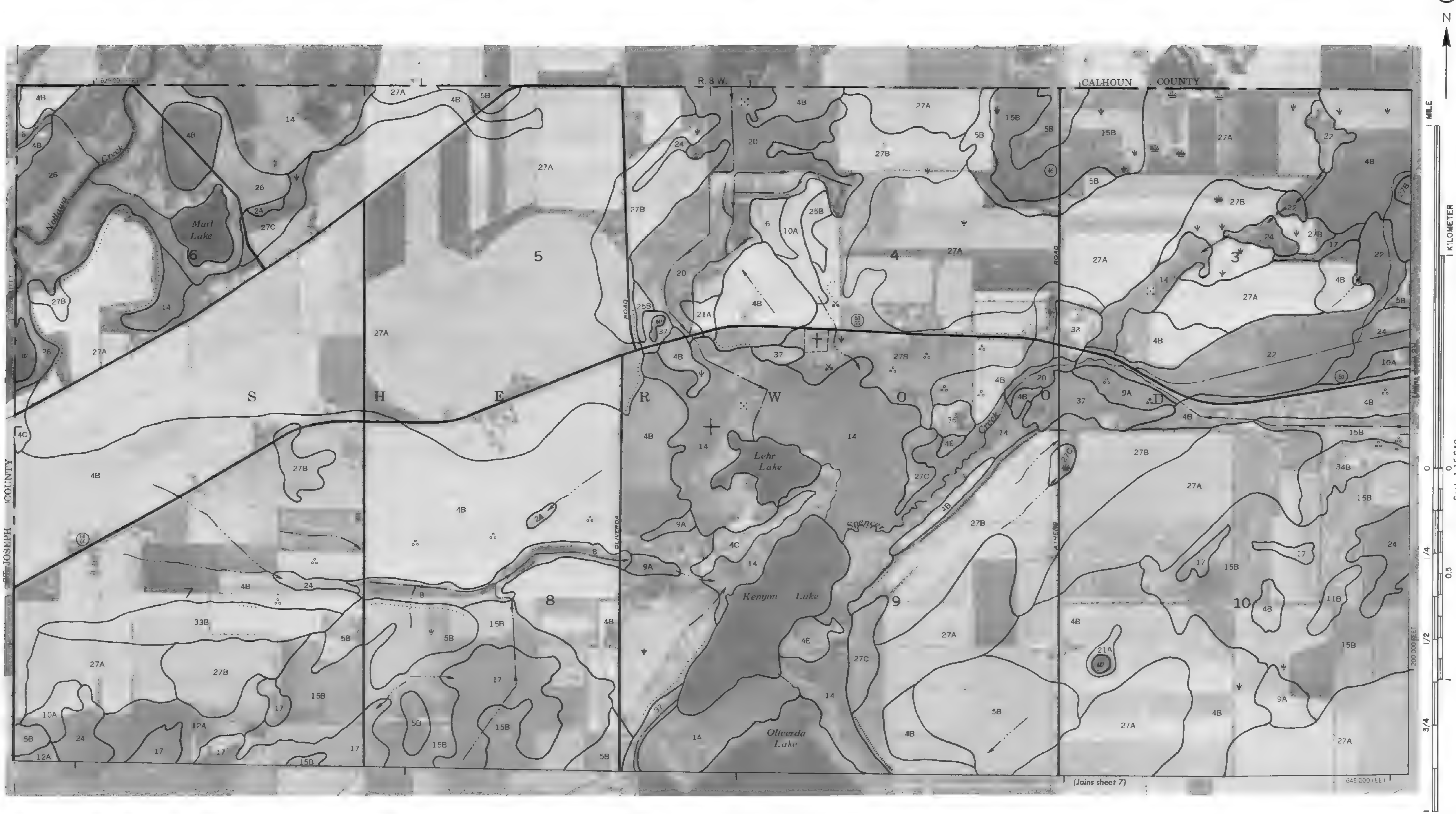
DEPRESSION OR SINK

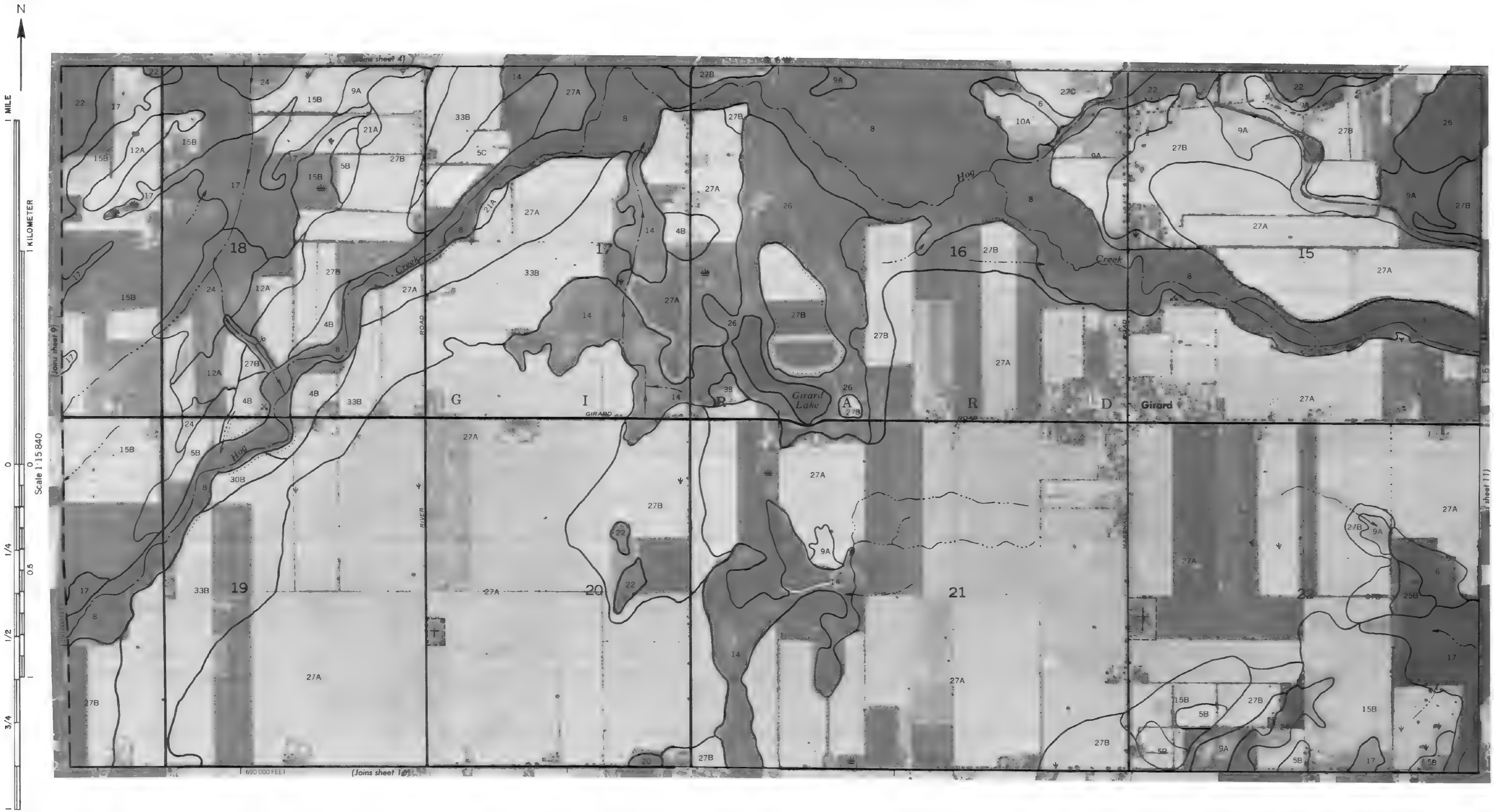
SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Sanitary landfill (6 acres or less)
- Cobbly area (10 acres or less)

SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 1

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1 MILE
1 KILOMETER
Scale 1:15 840
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1/4
1/2
3/4
0.5
(Joins sheet 4)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 16)
690 000 FEET
G I R A R D
GIRARD ROAD
RIVER ROAD
Hog Creek
Girard Lake
Girard
18
17
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15
19
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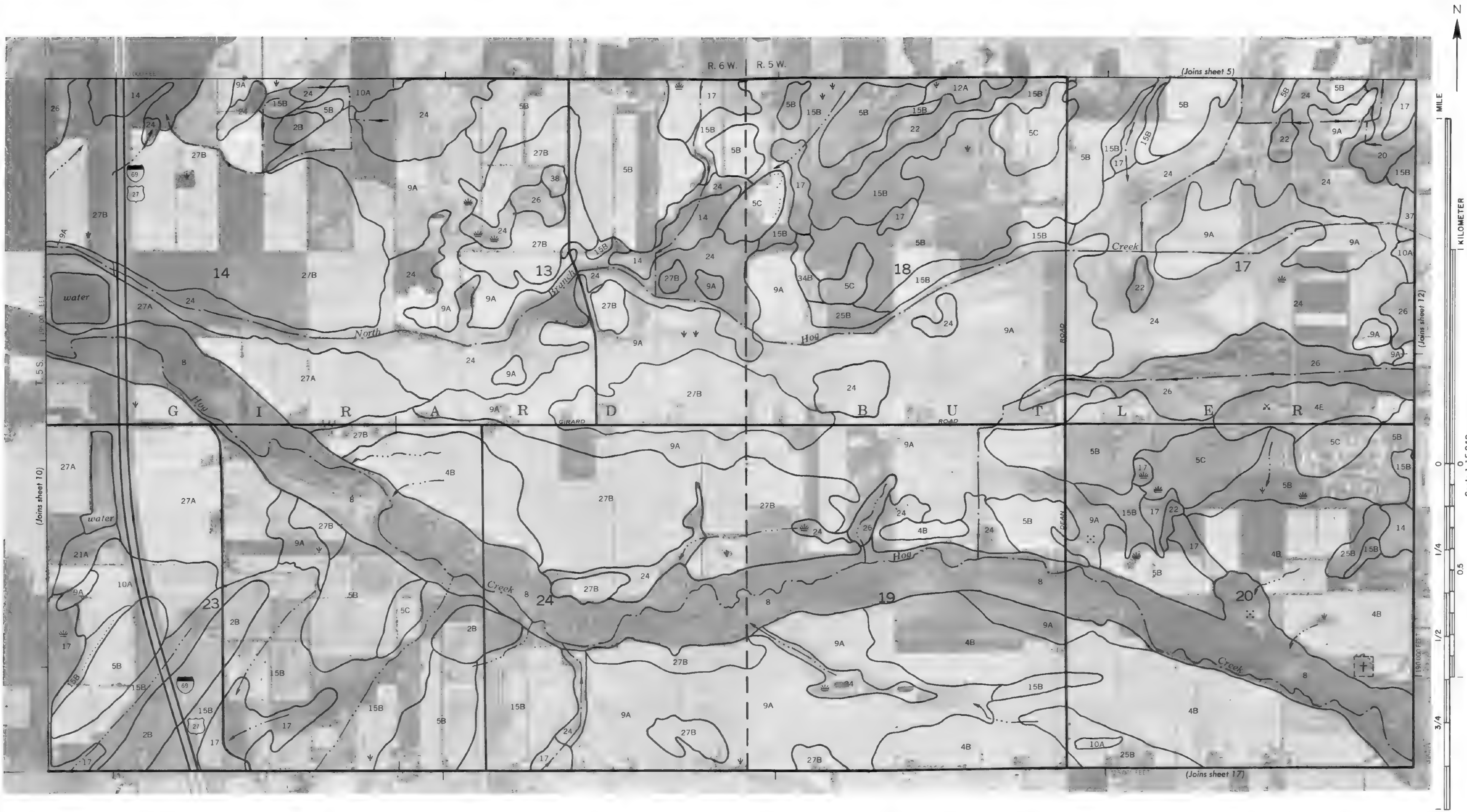
21
22


11
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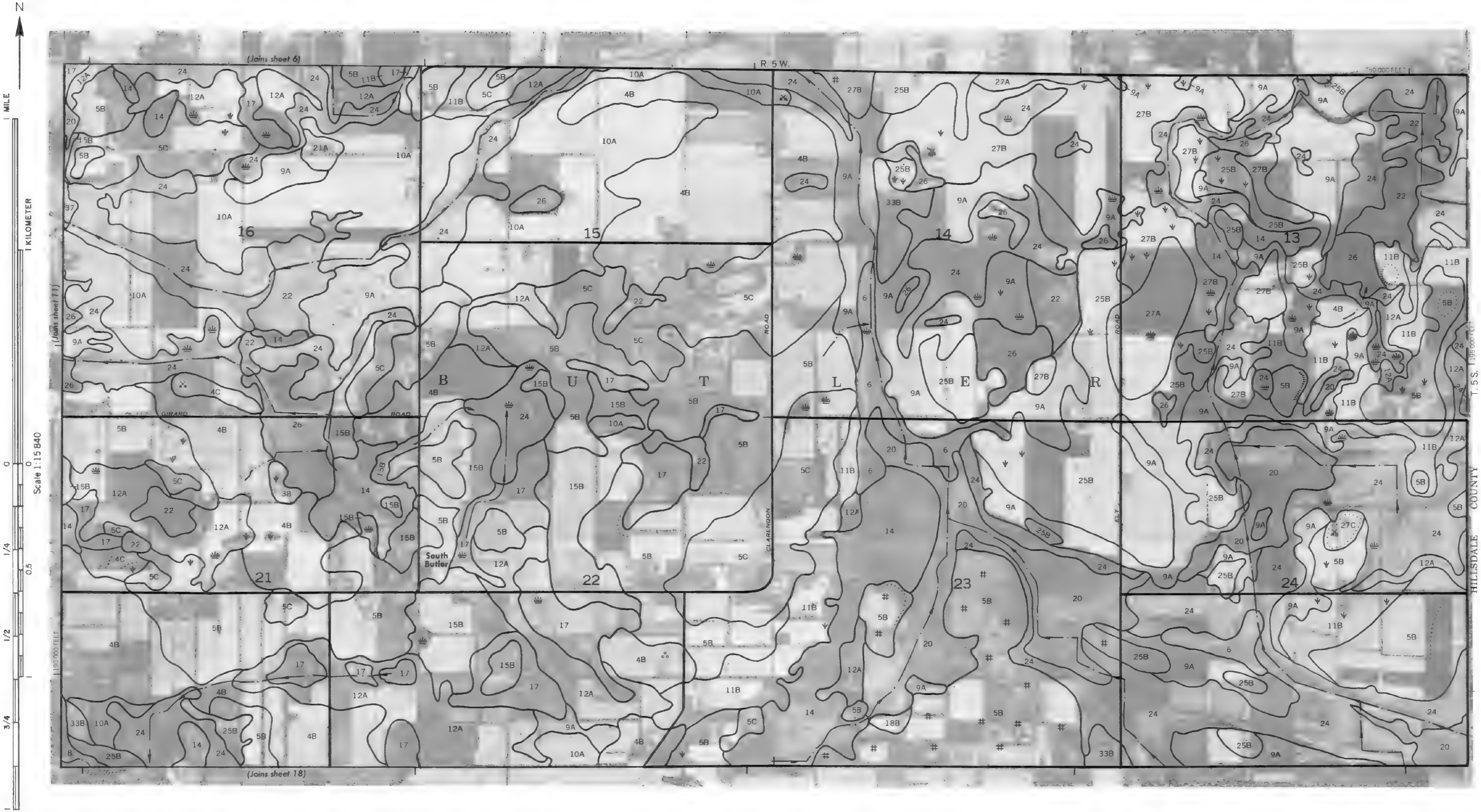
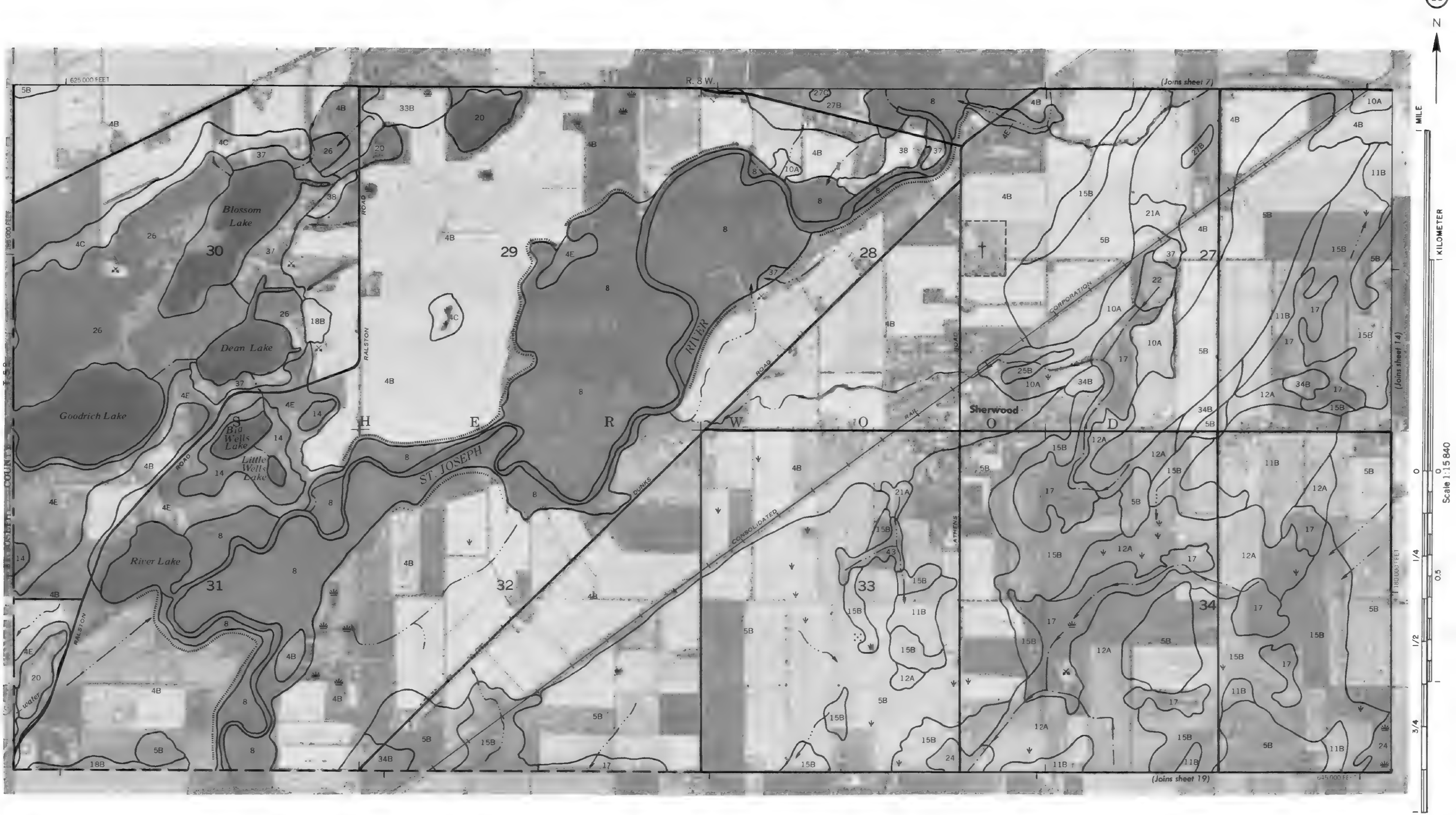
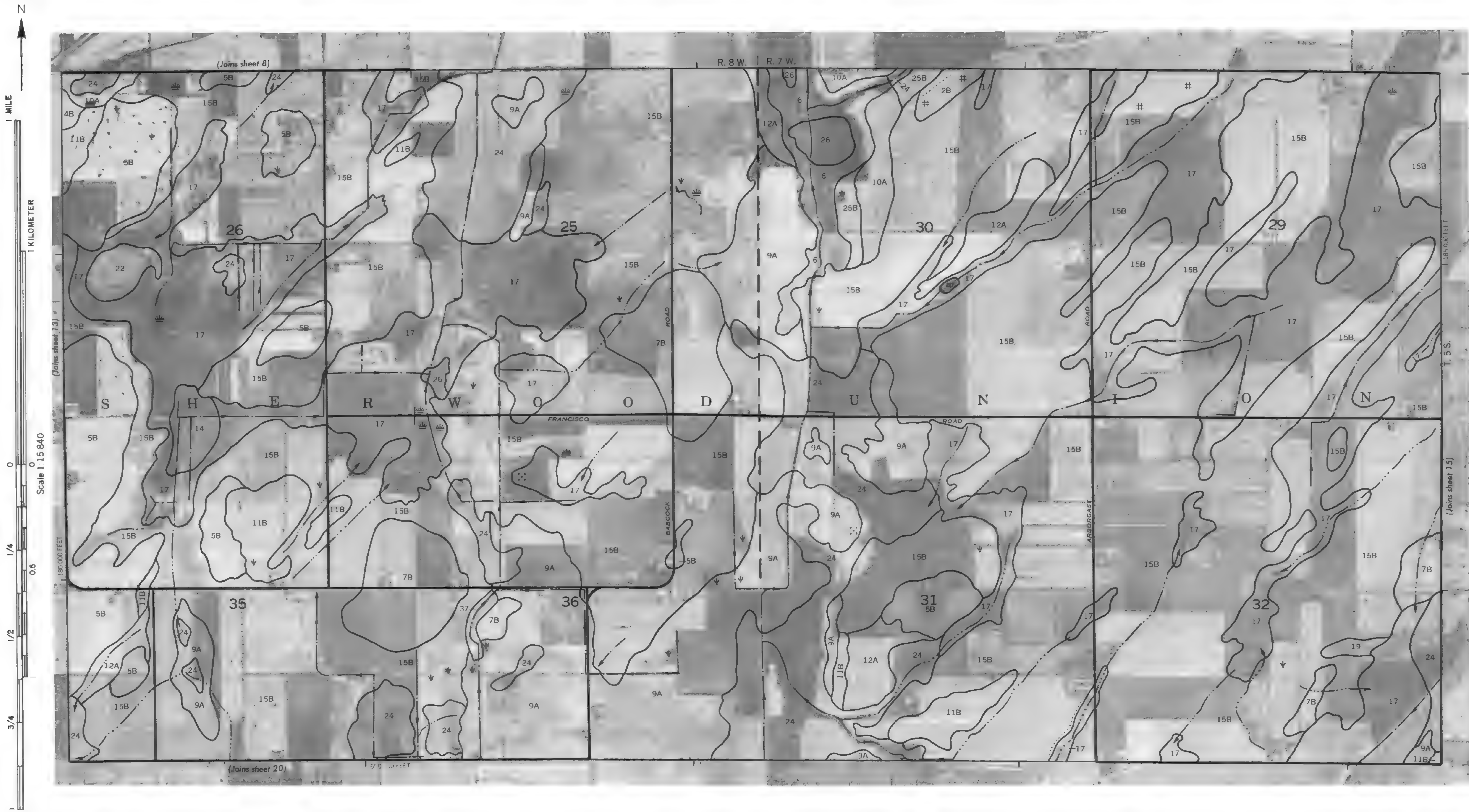
R. 6 W.
R. 5 W.
T. 5 S.
(Joins sheet 5)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 17)
G I R A R D
B U T L E R
GIRARD ROAD
DEAN ROAD
North Branch
Hog Creek
water
13
14
17
18
19
20
23
24
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

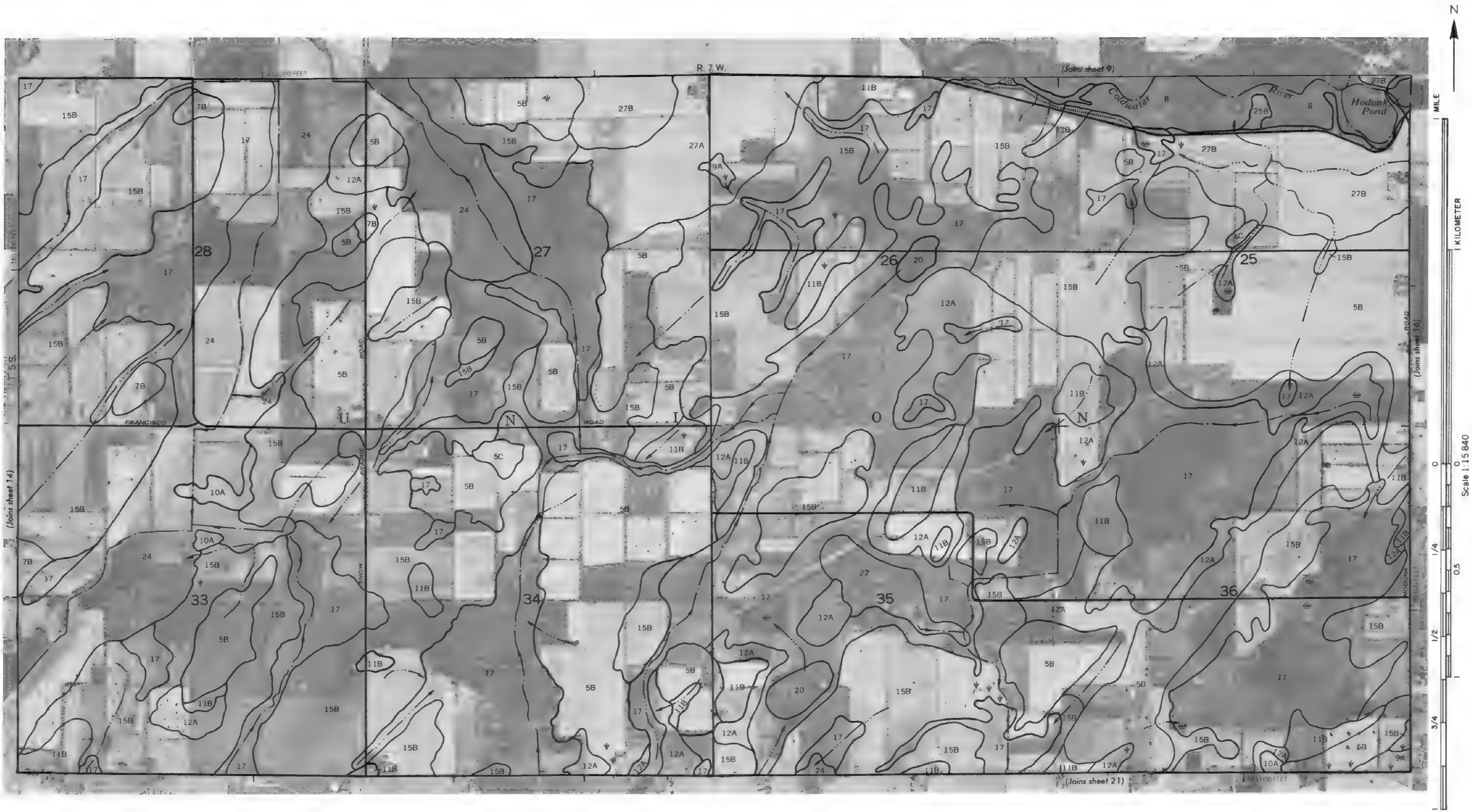
SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 12



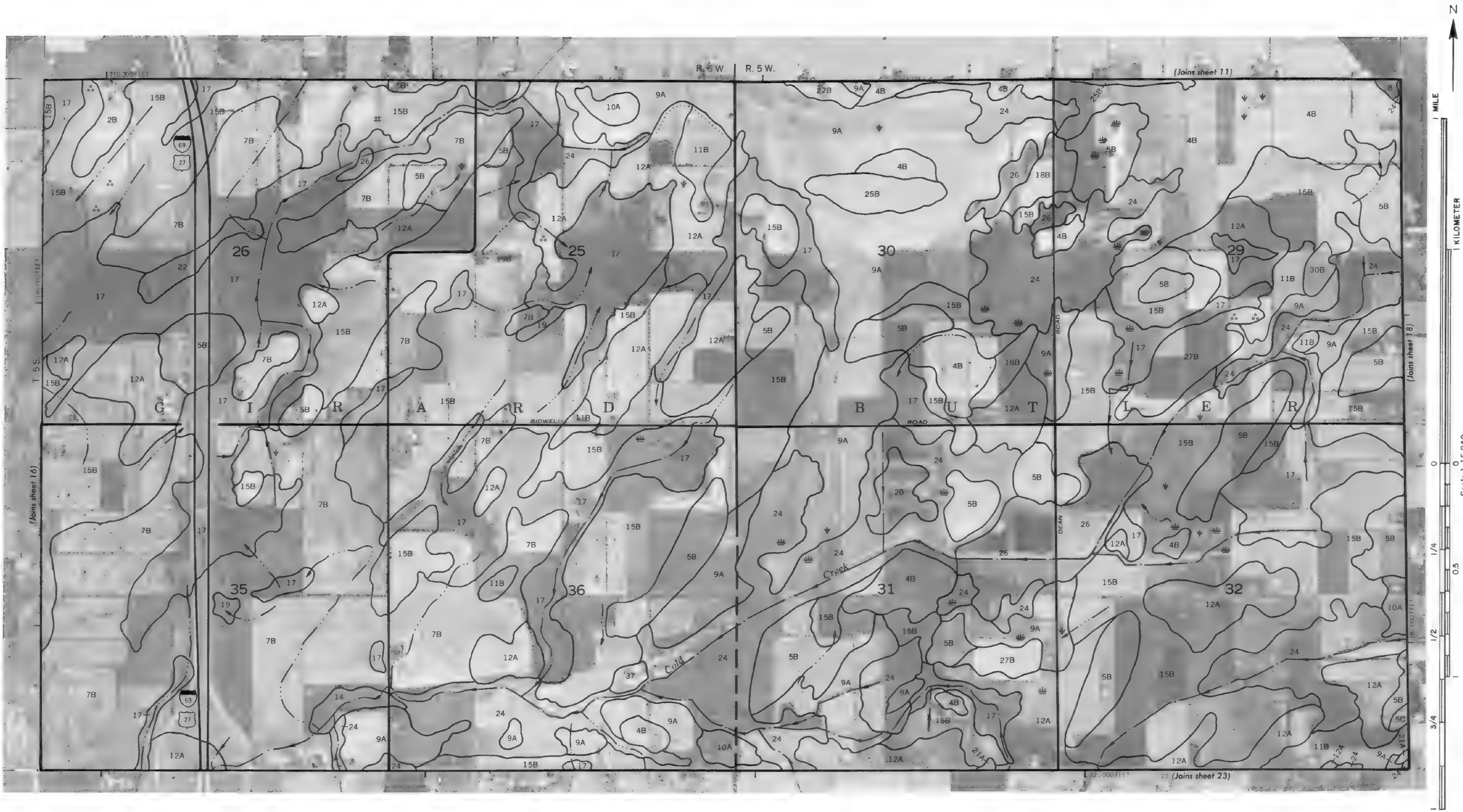

13
N
R. 8 W.
625 000 FEET
(Joins sheet 7)
(Joins sheet 14)
(Joins sheet 19)
645 000 FEET
Blossom Lake
Dean Lake
Goodrich Lake
Big Wells Lake
Little Wells Lake
River Lake
ST. JOSEPH
RIVER
S H E R W O O D
Sherwood
RALSTON
ROAD
DUNKS
CONSOLIDATED
RAIL
CORPORATION
ATHENS
water
30
29
28
27
31
32
33
34
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5


N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 8)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 20)
R. 8 W.
R. 7 W.
T. 5 S.
S H E R W O O D
U N I O N
FRANCISCO
ROAD
BABCOCK
ROAD
ARBORGAST
ROAD
26
25
30
29
35
36
31
32
180 000 FEET

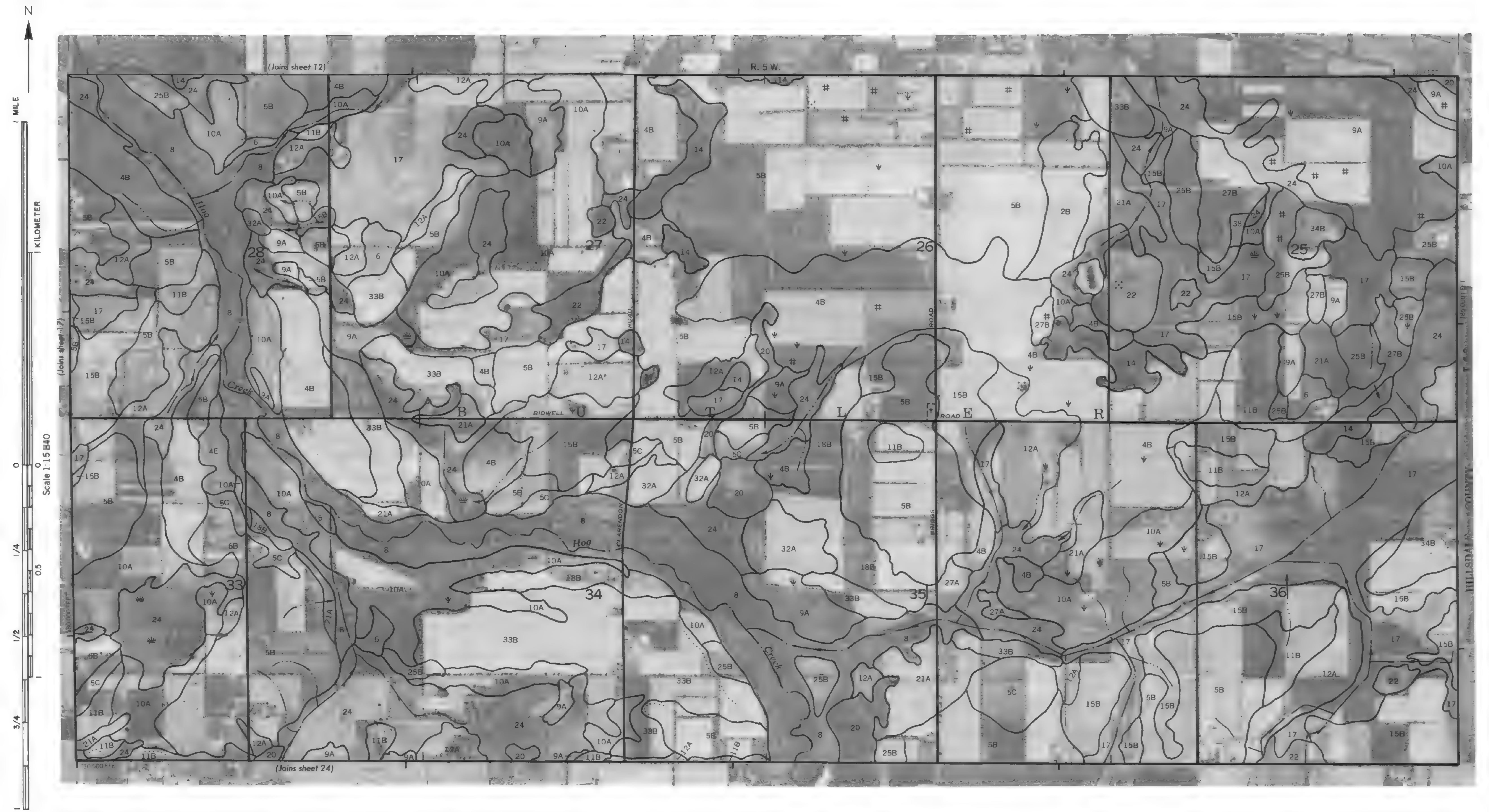
SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 15




N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 10)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 22)
R. 6 W.
T. 5 S.
COLDWATER
RIVER
Craig Lake
Morrison Lake
G I R A R D
BIDWELL ROAD
MARSHALL ROAD
RIVER ROAD
27
28
29
30
31
32
33
34

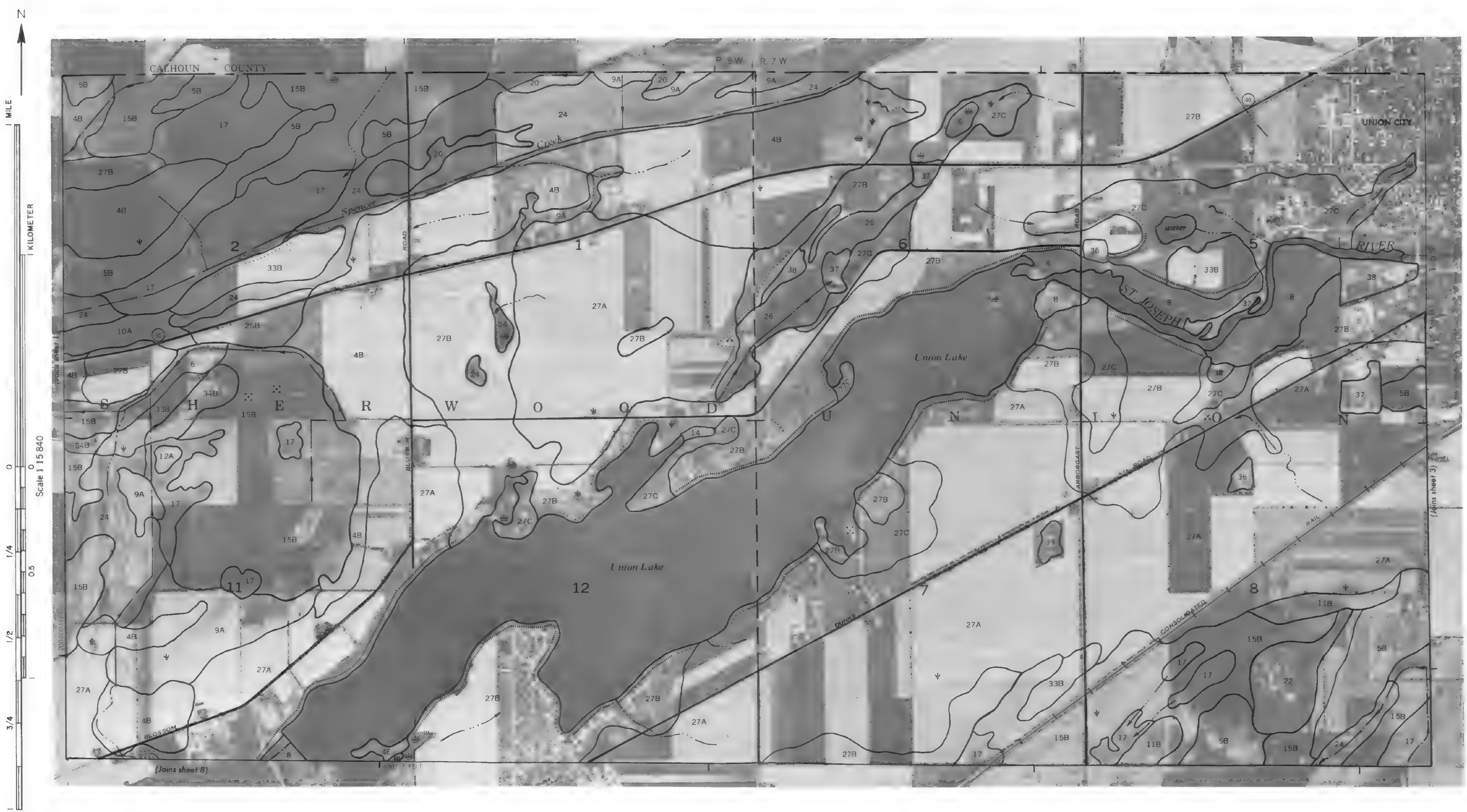

N
R. 6 W.
R. 5 W.
T. 5 S.
(Joins sheet 11)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 23)
710 000 FEET
185 000 FEET
172 000 FEET
GIRARD
BUTLER
BIDWELL
ROAD
DEAN ROAD
Cold Creek
26
25
30
29
35
36
31
32
69
27
1 MILE
1 KILOMETER
Scale 1:15 840

(18)

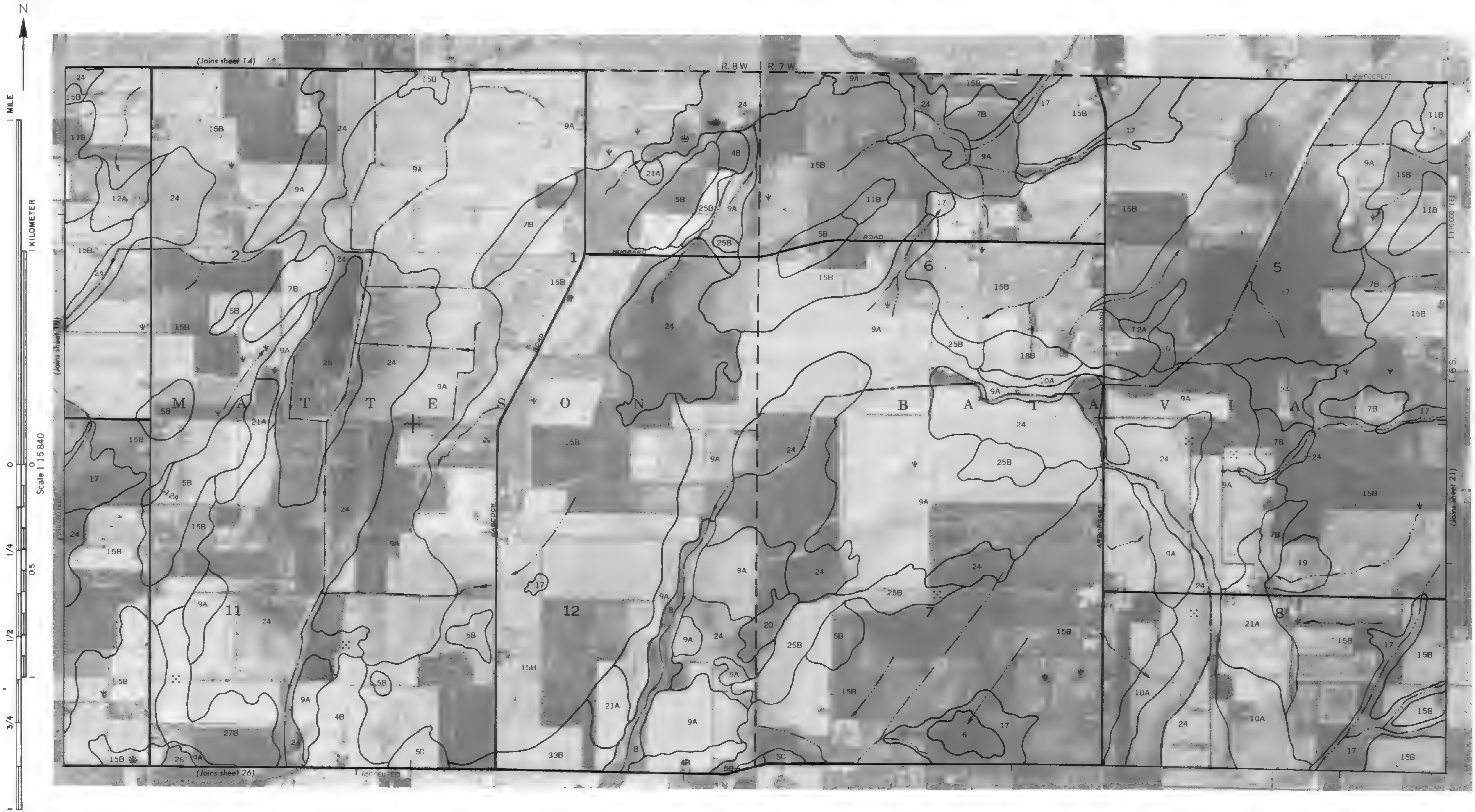

N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 12)
R. 5 W.
(Joins sheet 17)
(Joins sheet 24)
BUTLER
HILLSDALE COUNTY
BIDWELL
ROAD
CLARENDON
BRIGGS
Hog
Creek
28
27
26
25
33
34
35
36

SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 19

SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 2

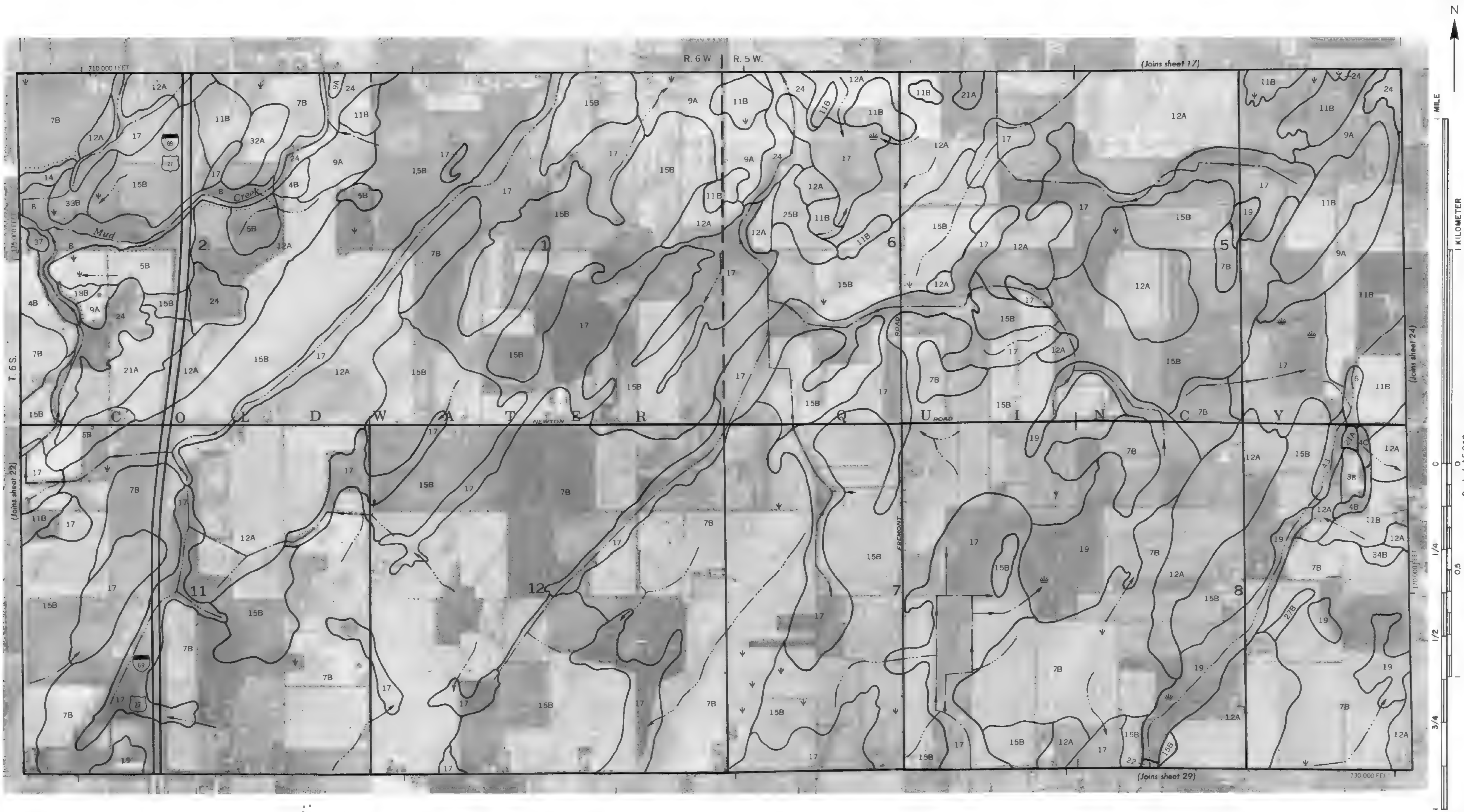


SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 20

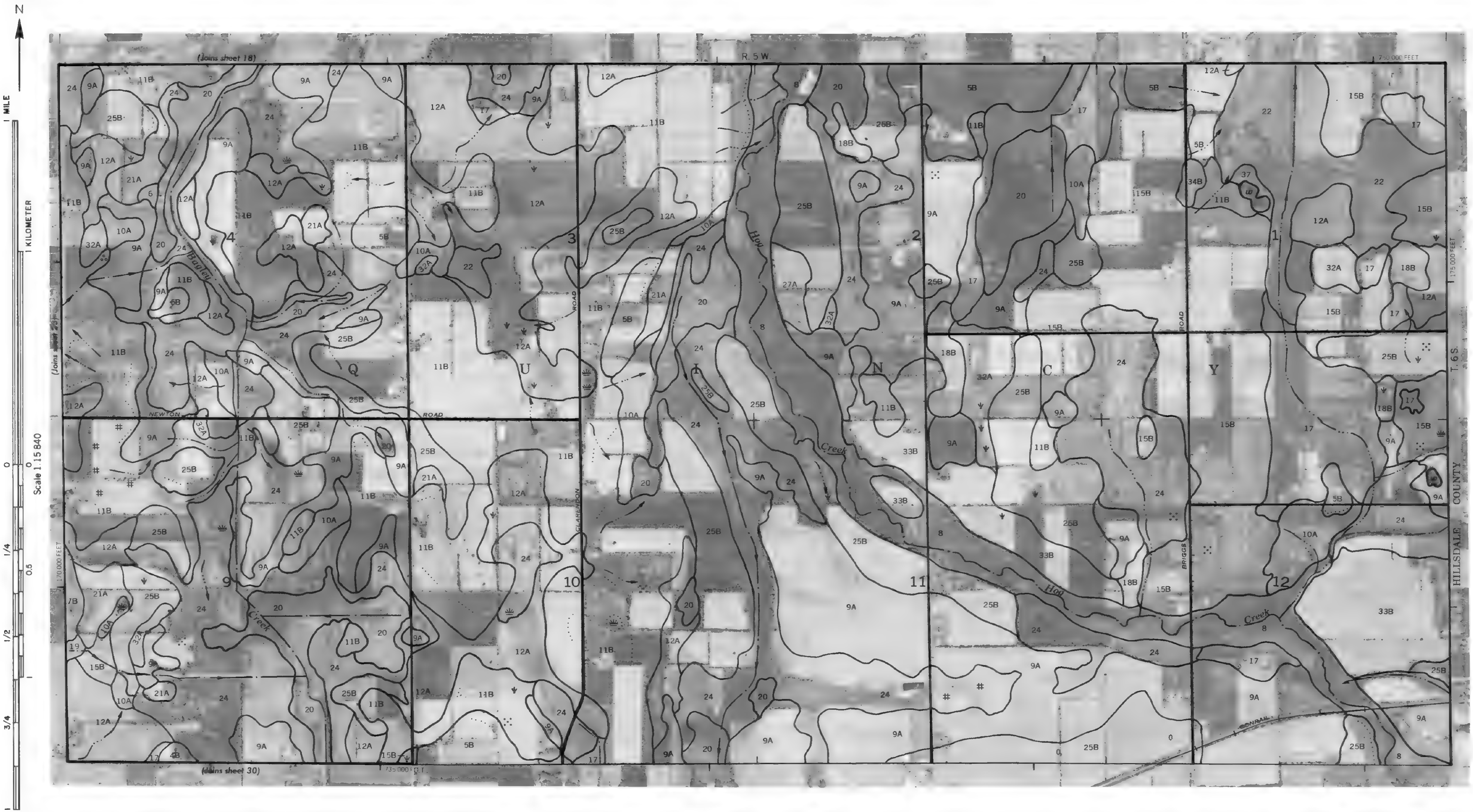


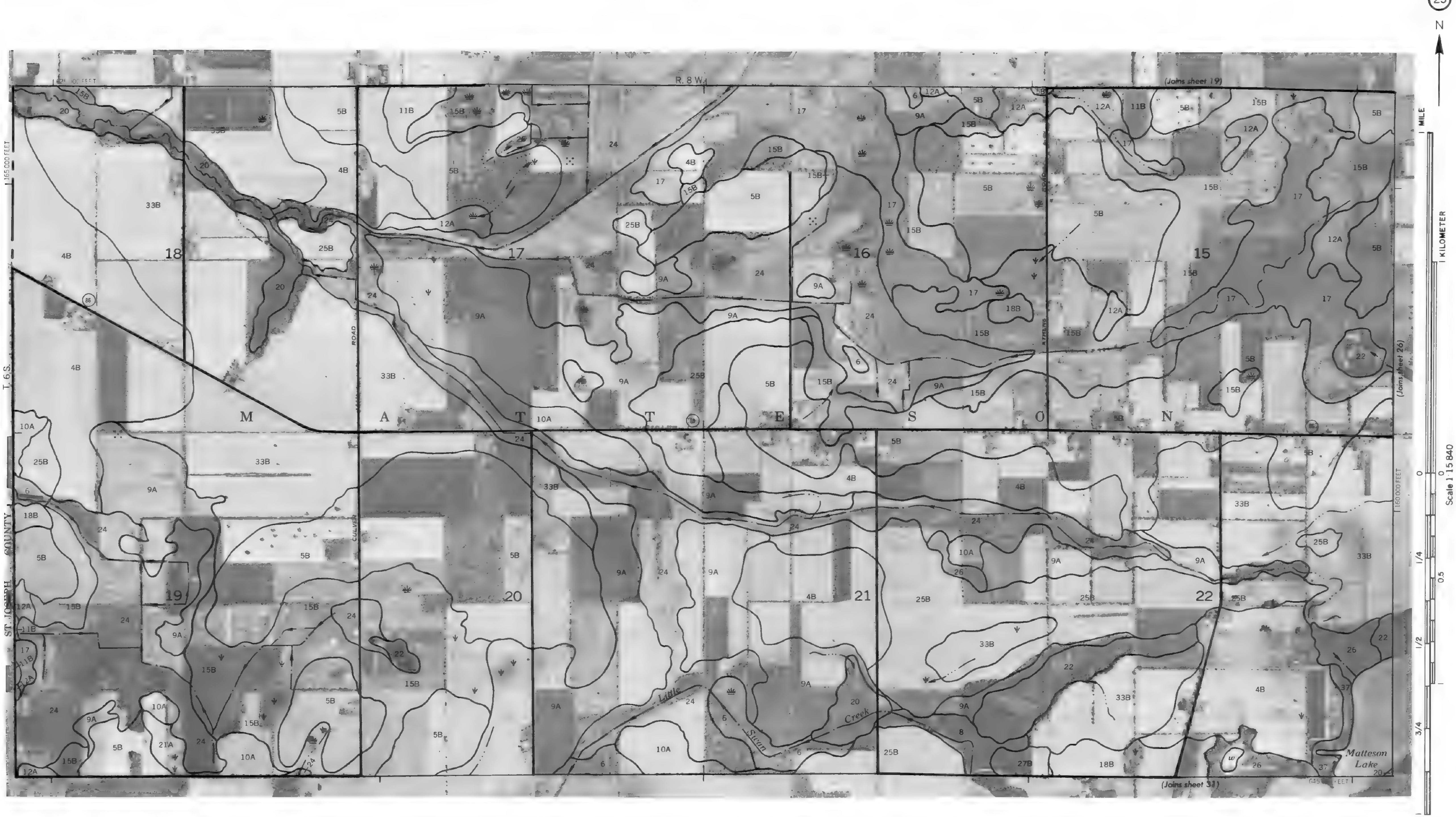

N
R. 7 W.
670 000 FEET
175 000 FEET
(Joins sheet 15)
(Joins sheet 22)
(Joins sheet 27)
(Joins sheet 20)
T. 6 S.
B A T A V I A
1
2
3
4
9
10
11
12
PRAIRIE
SNOW ROAD
WHEELER ROAD
MILLER ROAD
LAKE ROAD
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
170 000 FEET
685 000 FEET

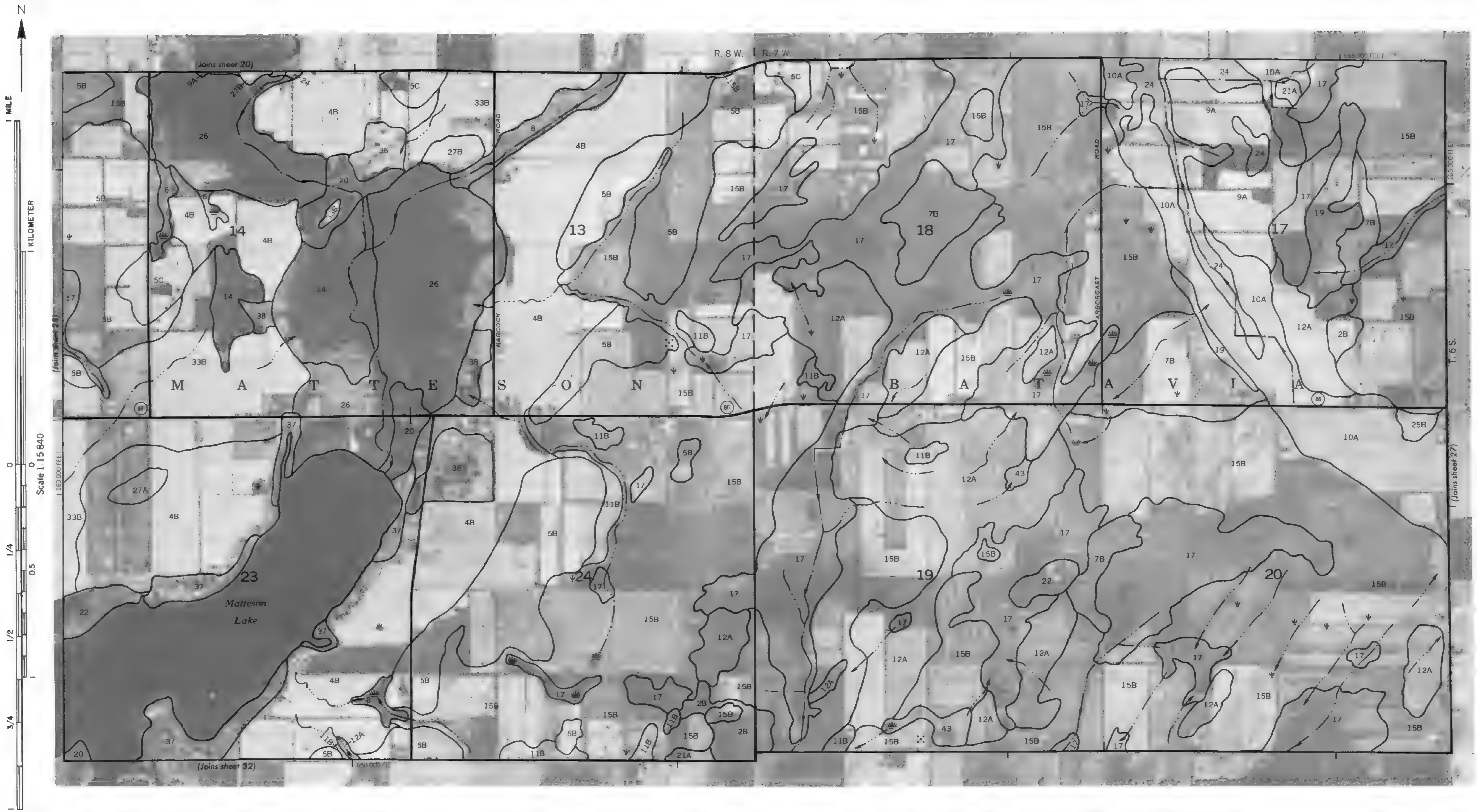

N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 16)
R. 6 W.
Morrison Lake
Randall Lake
North Lake
water
C O L D W A T E R
MILLER LAKE ROAD
Mud Creek
T. 6 S.
(Joins sheet 28)


N
(Joins sheet 17)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 29)
R. 6 W.
R. 5 W.
T. 6 S.
710 000 FEET
175 000 FEET
170 000 FEET
730 000 FEET
C O L D W A T E R
Q U I N C Y
NEWTON ROAD
FREMONT ROAD
ROAD
Mud
Creek
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

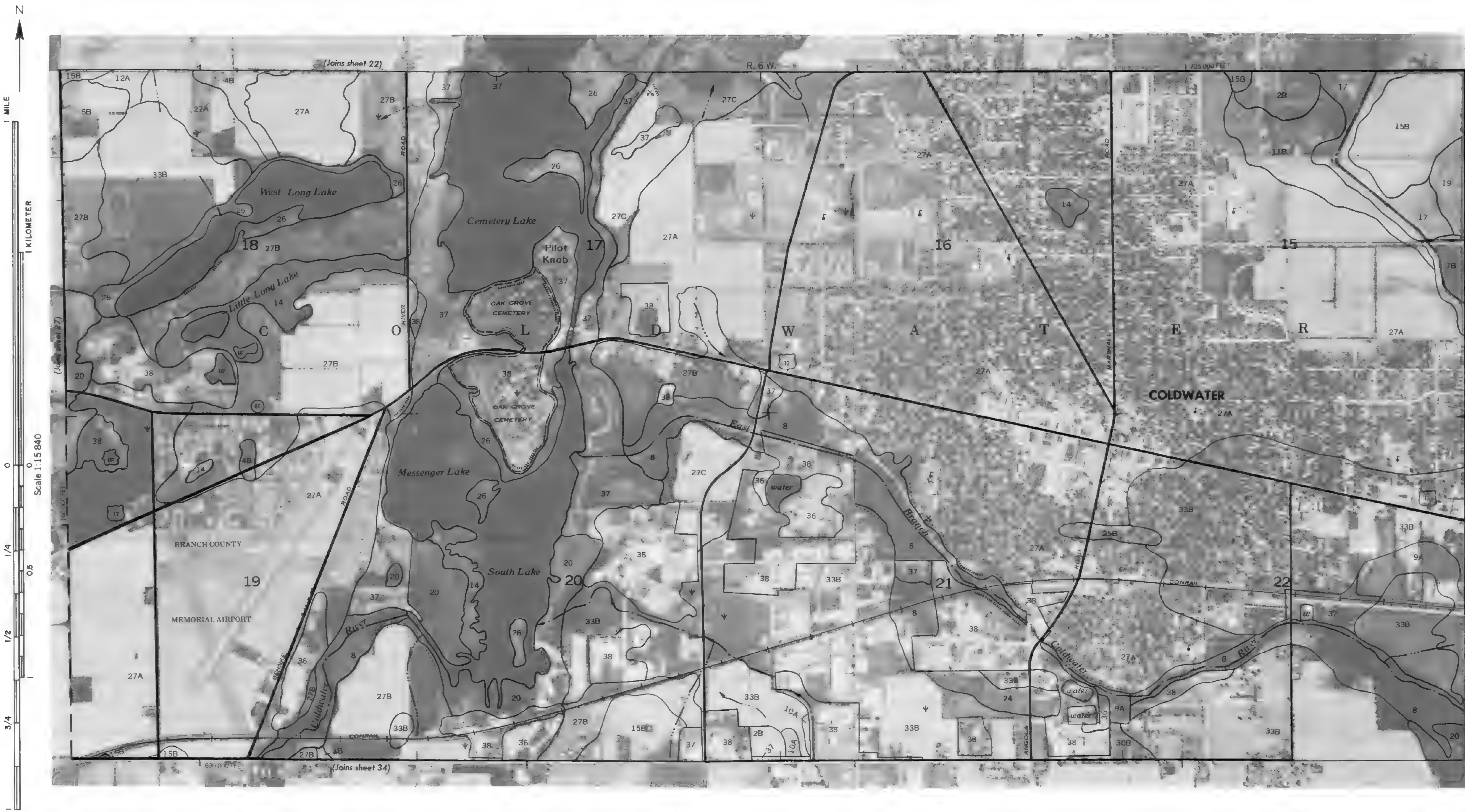
SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 24

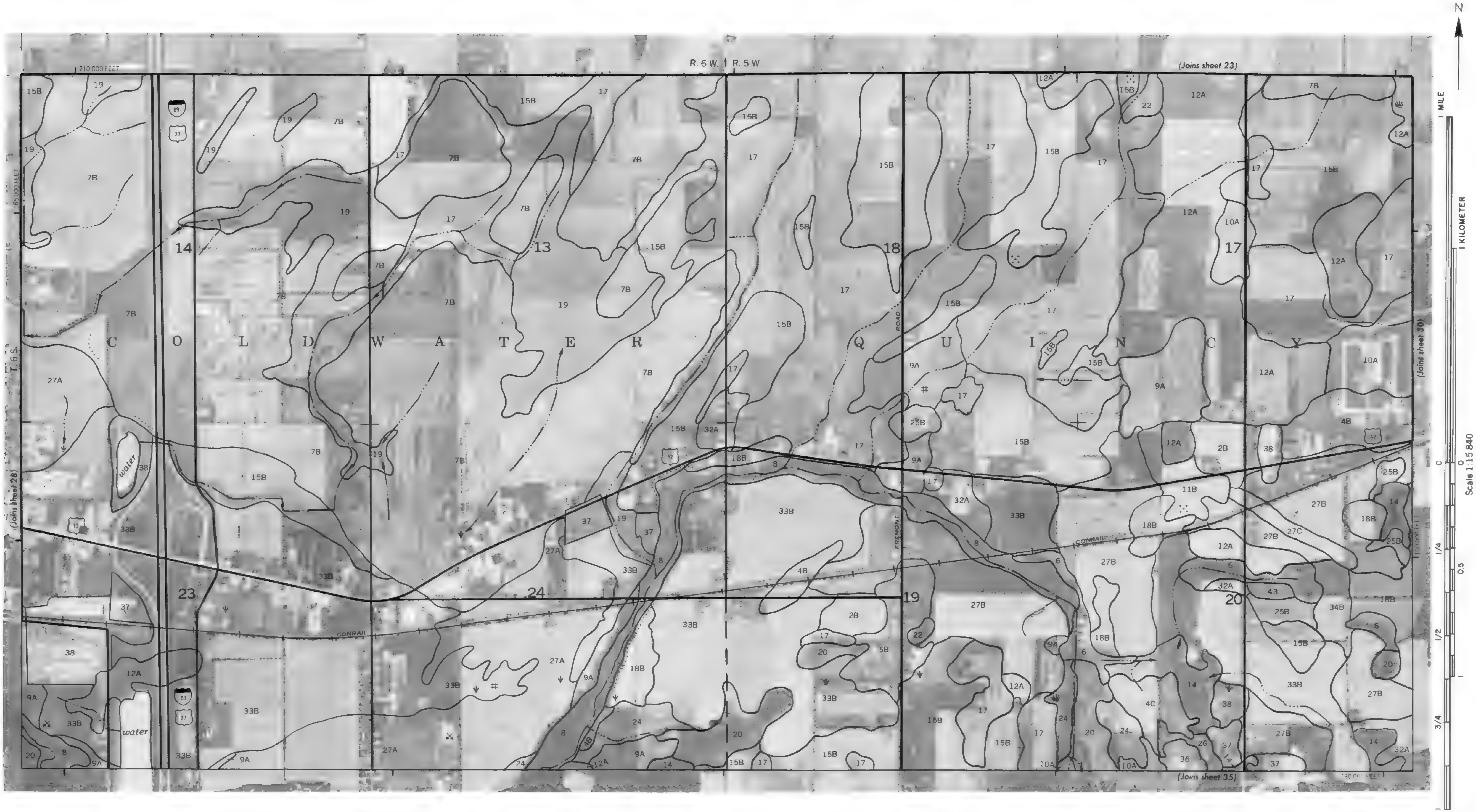


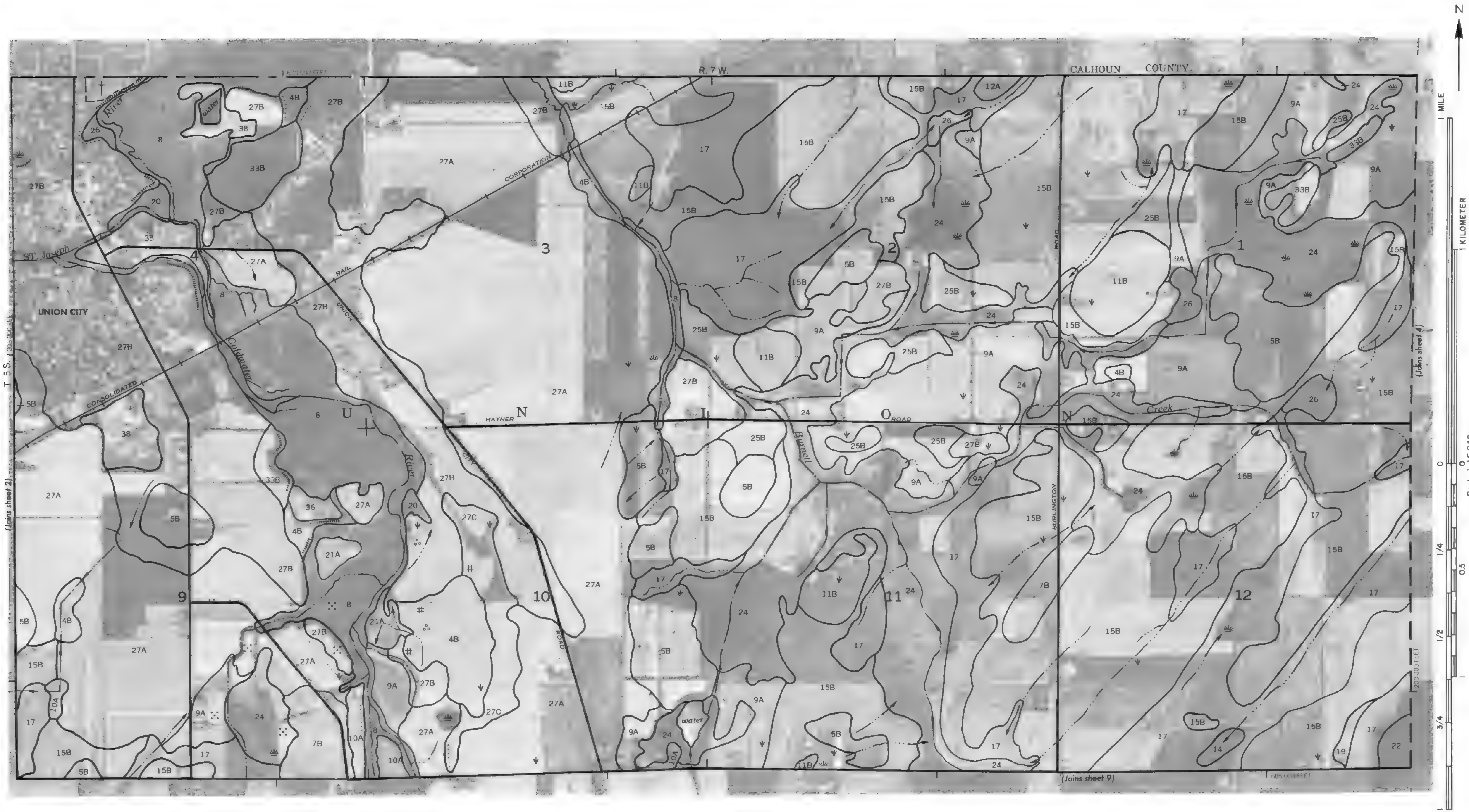

25
N
R. 8 W.
(Joins sheet 19)
(Joins sheet 26)
(Joins sheet 31)
T. 6 S.
ST. JOSEPH COUNTY
M A T T E S O N
CULVER ROAD
Little Swan Creek
Matteson Lake
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
165 000 FEET
160 000 FEET
18
17
16
15
19
20
21
22

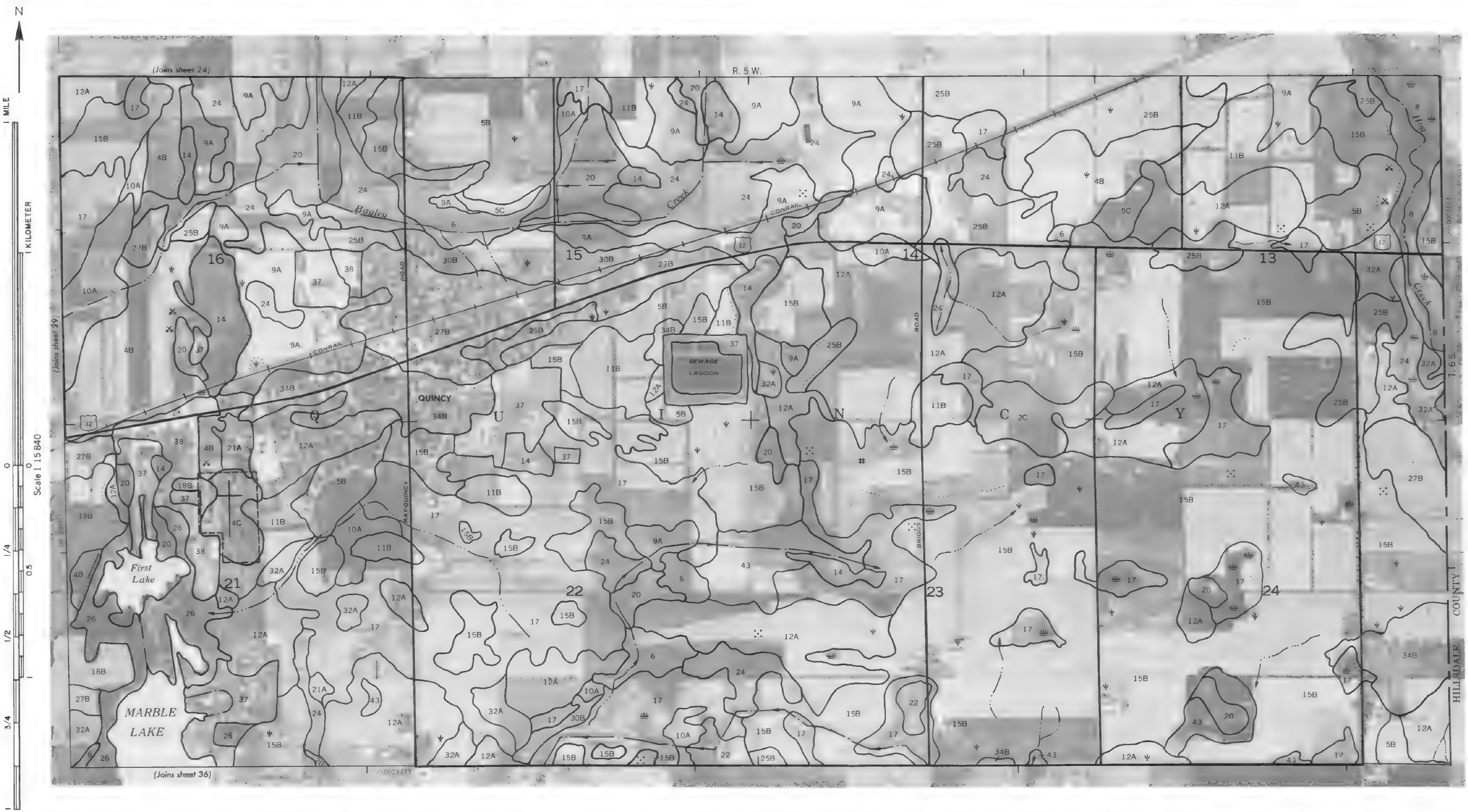

26
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 20)
(Joins sheet 32)
(Joins sheet 27)
R. 8 W.
R. 7 W.
T. 6 S.
M A T T E S O N
B A T A V I A
BABCOCK ROAD
ARBORGAST ROAD
Matteson Lake
14
13
18
17
23
24
19
20
160 000 FEET
650 000 FEET
165 000 FEET
86

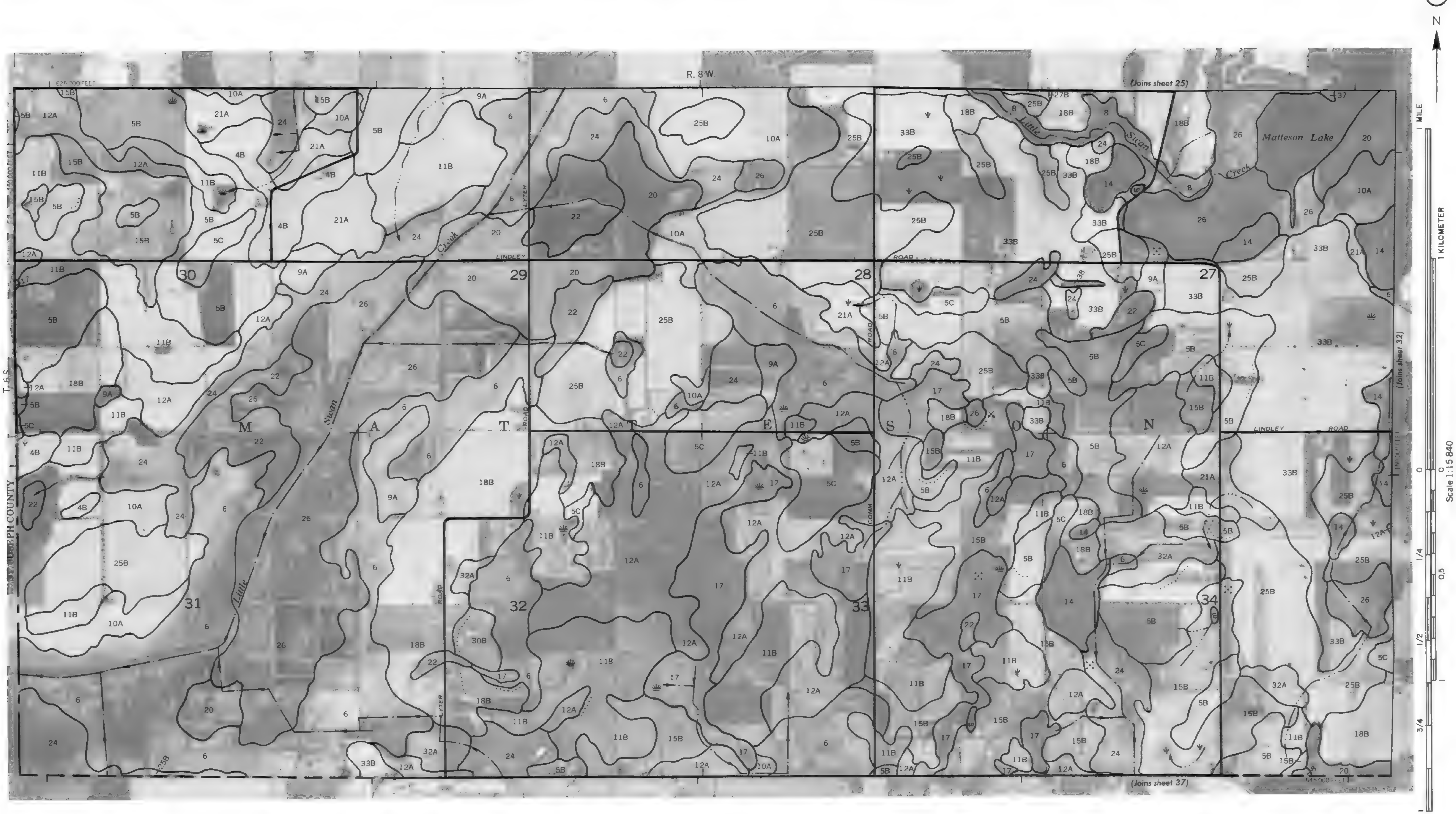

27
N
(Joins sheet 21)
(Joins sheet 26)
(Joins sheet 28)
(Joins sheet 33)
R. 7 W.
T. 6 S.
670 000 FEET
165 000 FEET
160 000 FEET
685 000 FEET
B A T A V I A
16
15
14
13
21
22
23
24
Batavia Center
PRAIRIE
SNOW
ROAD
WHEELER ROAD
Swan Creek
Cooks Lake
water
w
86
12
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
0.5
1/2
3/4

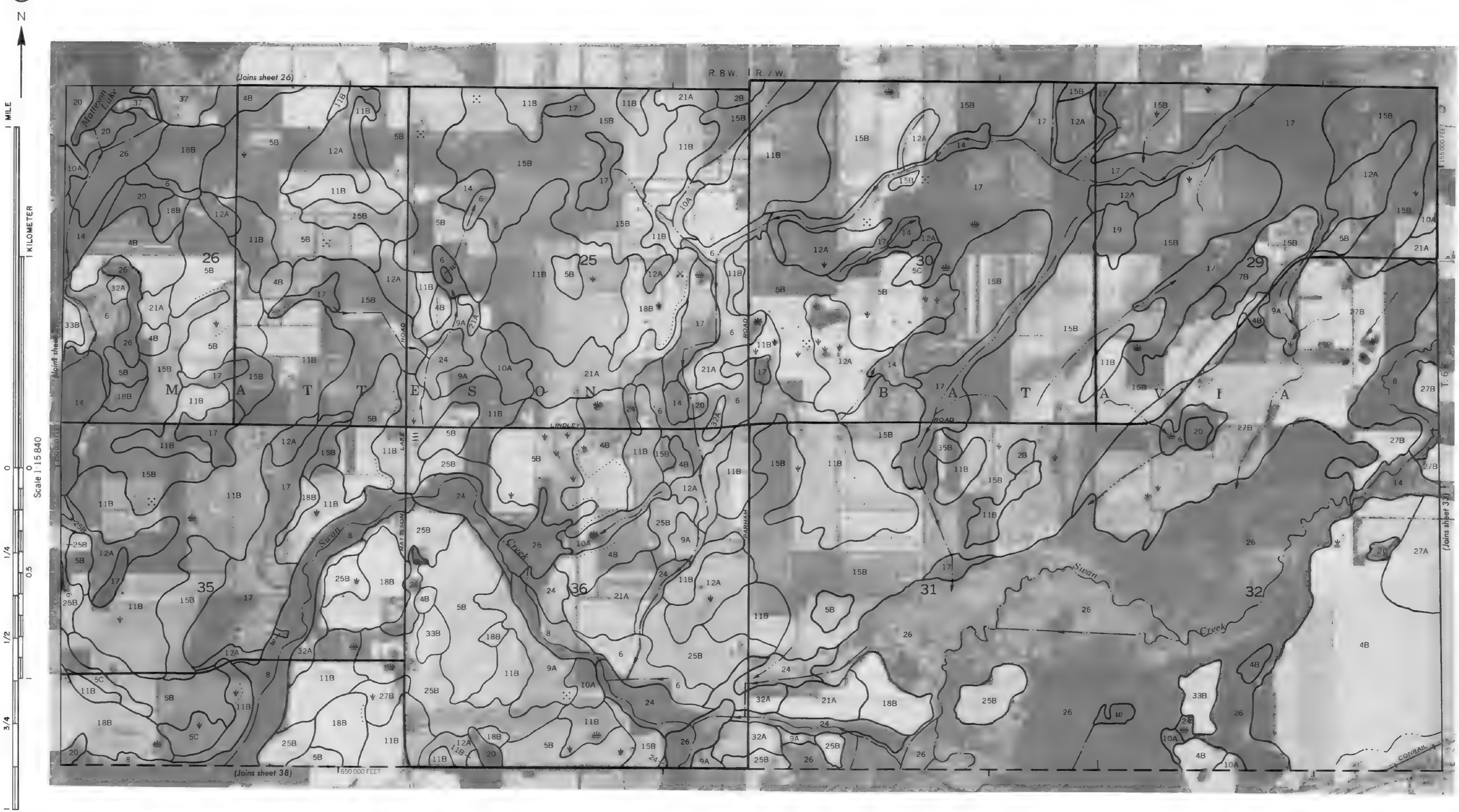

N
MILE
KILOMETER
Scale 1:15 840
(Joins sheet 22)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 34)
R. 6 W.
T. 6 S.
705 000 FEET
690 000 FEET
165 000 FEET
160 000 FEET
West Long Lake
Little Long Lake
Cemetery Lake
Pilot Knob
OAK GROVE CEMETERY
Messenger Lake
South Lake
East Branch
Coldwater River
C O L D W A T E R
COLDWATER
BRANCH COUNTY
MEMORIAL AIRPORT
RIVER ROAD
MARSHALL ROAD
ANGOLA ROAD
CONRAIL
water
15 16 17 18 19 20 21 22


N
R. 6 W.
R. 5 W.
710 000 FEET
(Joins sheet 23)
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 35)
T. 6 S.
COLDWATER
QUINCY
14
13
18
17
23
24
19
20
CONRAIL
FREMONT ROAD
water
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

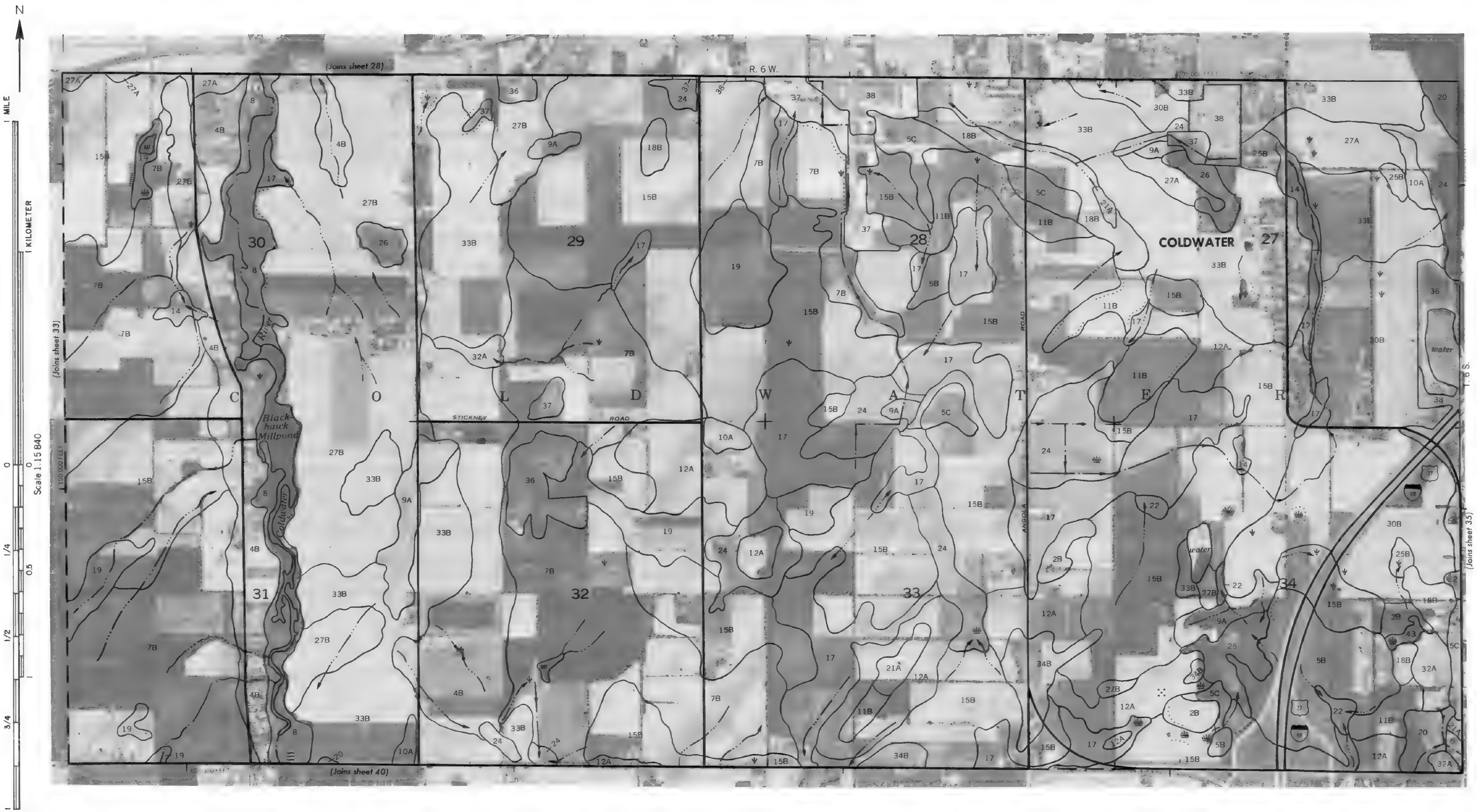

N
R. 7 W.
CALHOUN COUNTY
T. 5 S.
UNION CITY
ST. Joseph River
Coldwater River
CONSOLIDATED RAIL CORPORATION
UNION
HAYNER ROAD
BURLINGTON ROAD
Burnett
Creek
UNION
water
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5
200 000 FEET
685 000 FEET

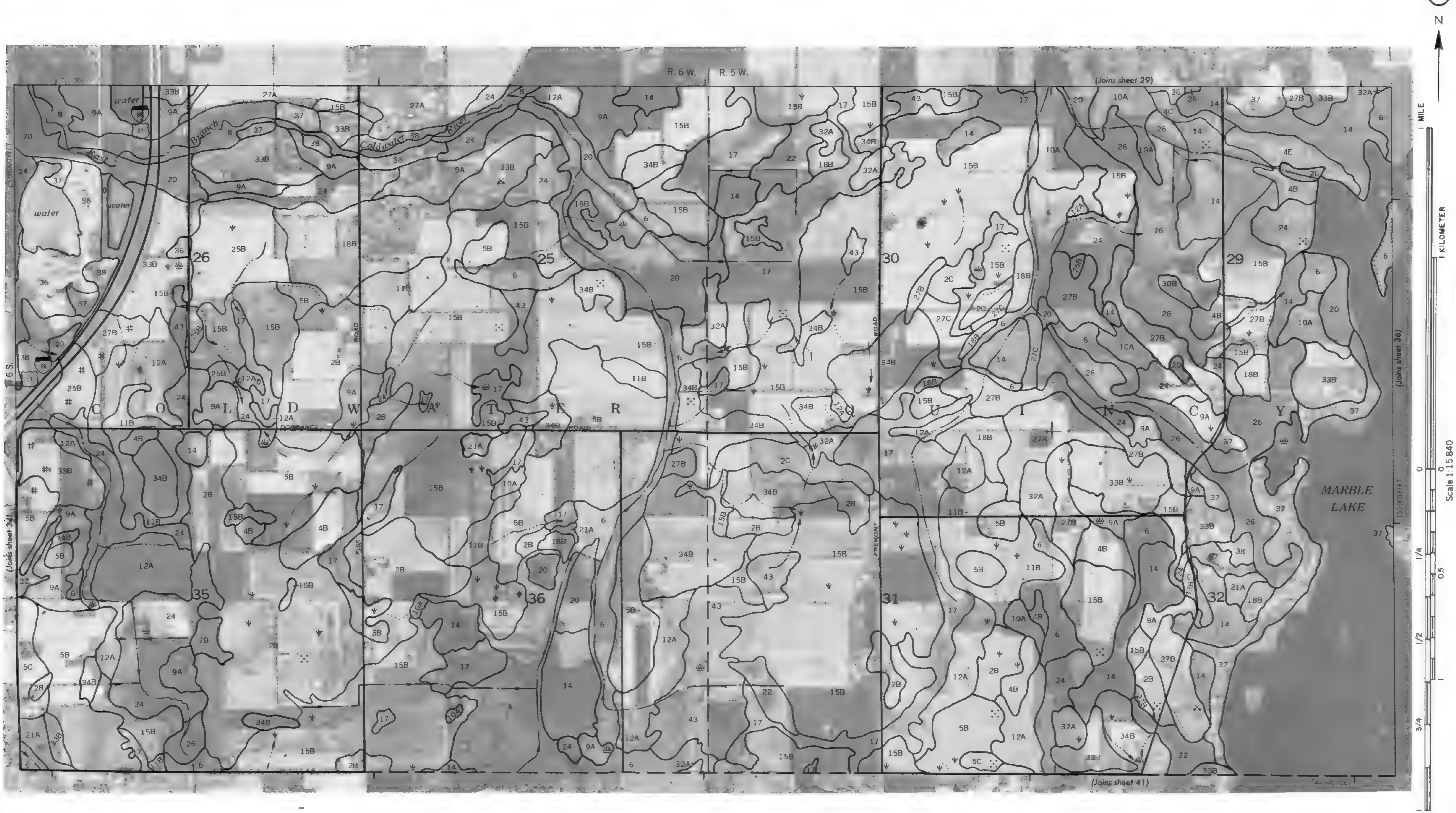

N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 24)
R. 5 W.
(Joins sheet 29)
(Joins sheet 36)
QUINCY
SEWAGE
LAGOON
Bagley
Creek
CONRAIL
ROAD
RAY-QUINCY
BRIGGS
First
Lake
MARBLE
LAKE
T. 6 S.
HILLSDALE
COUNTY
16
15
14
13
21
22
23
24


31
N
R. 8 W.
(Joins sheet 25)
Matteson Lake
Little Swan Creek
LINDLEY ROAD
LYTER ROAD
COMM ROAD
(Joins sheet 32)
(Joins sheet 37)
T. 6 S.
ST. JOSEPH COUNTY
M A T T E S O N
29
28
27
30
31
32
33
34
1 MILE
1 KILOMETER
Scale 1:15 840

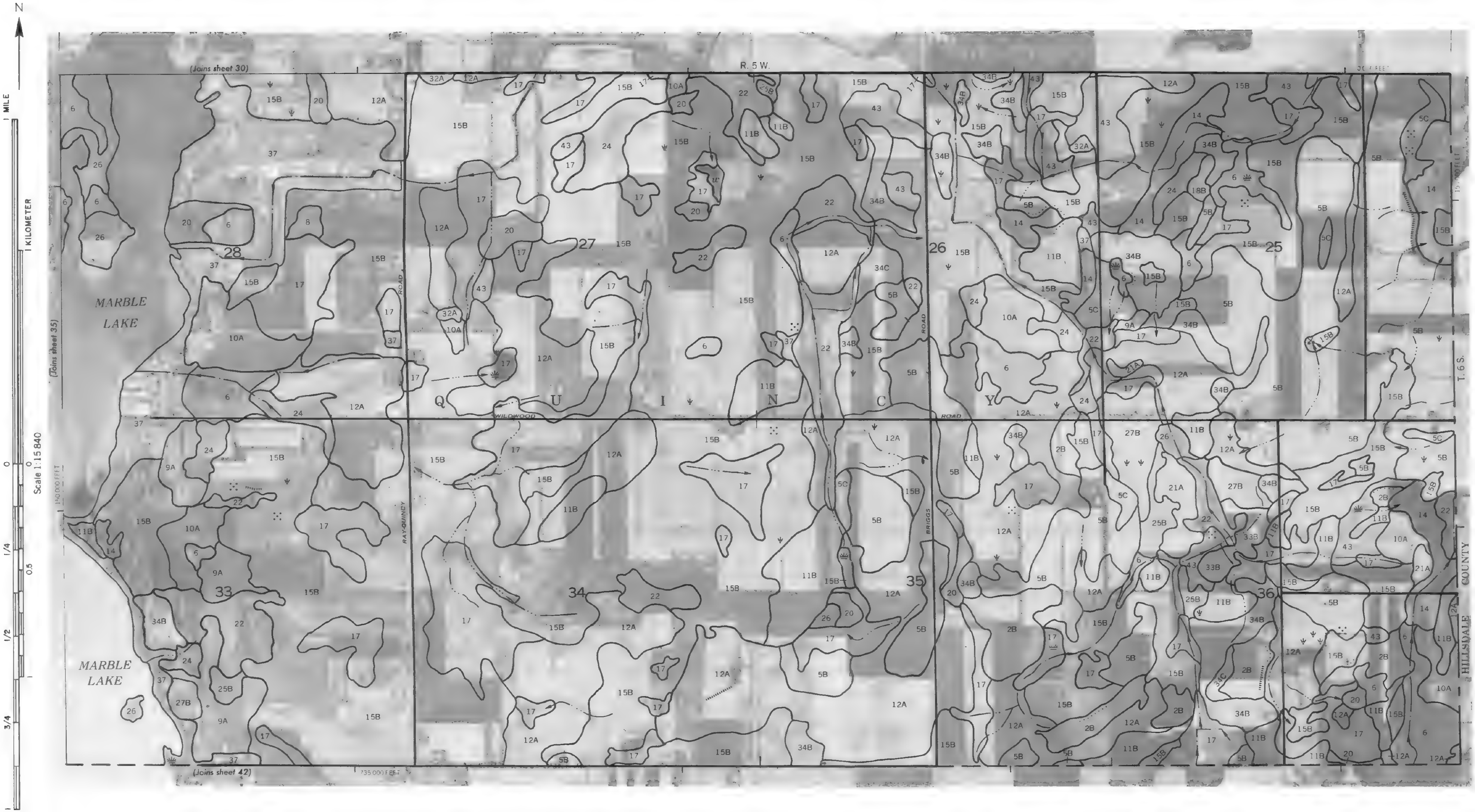

N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 26)
R. 8 W.
R. 7 W.
Matteson Lake
M A T T E S O N
B A T A V I A
LINDLEY
ROAD
MATTESON
LAKE
PARHAM
ROAD
Swan Creek
Swan Creek
CONRAIL
(Joins sheet 38)
650 000 FEET
155 000 FEET
(Joins sheet 31)
26
25
30
29
35
36
31
32

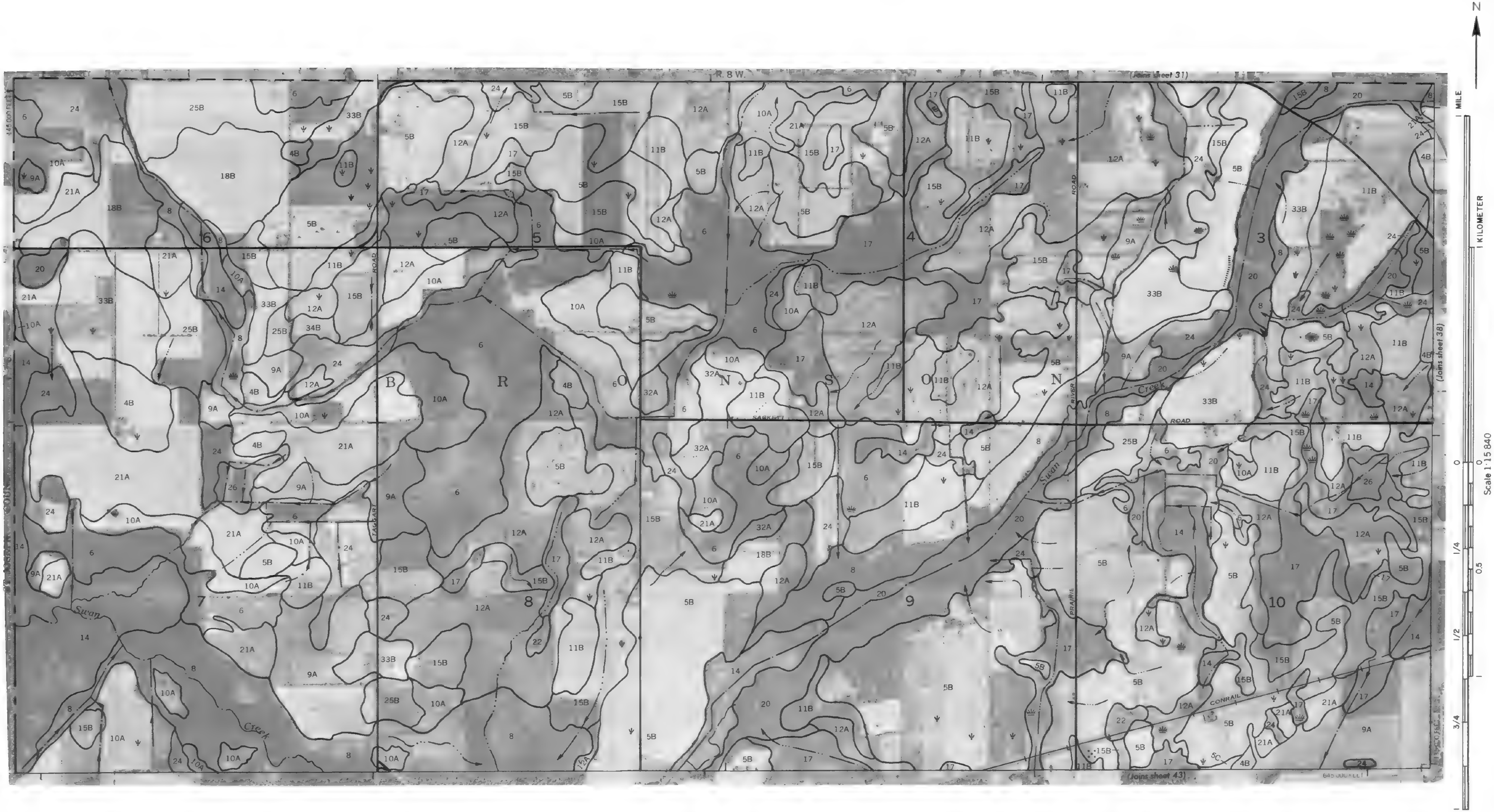

33
N
(Joins sheet 27)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 39)
R. 7 W.
T. 6 S.
670 000 FEET
685 000 FEET
Cooks Lake
Lime Lake
Dorsey Lake
Cary Lake
water
Swan Creek
LINDLEY ROAD
PRAIRIE ROAD
SNOW ROAD
BATAVIA ROAD
CONSOLIDATED RAIL CORPORATION
B A T A V I A
25
26
27
28
33
34
35
36
1 MILE
1 KILOMETER
Scale 1:15 840


N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 28)
R. 6 W.
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 40)
T. 6 S.
C O L D W A T E R
COLDWATER
STICKNEY ROAD
ANGOLA ROAD
Black-hawk Millpond
Coldwater River
water
27
28
29
30
31
32
33
34

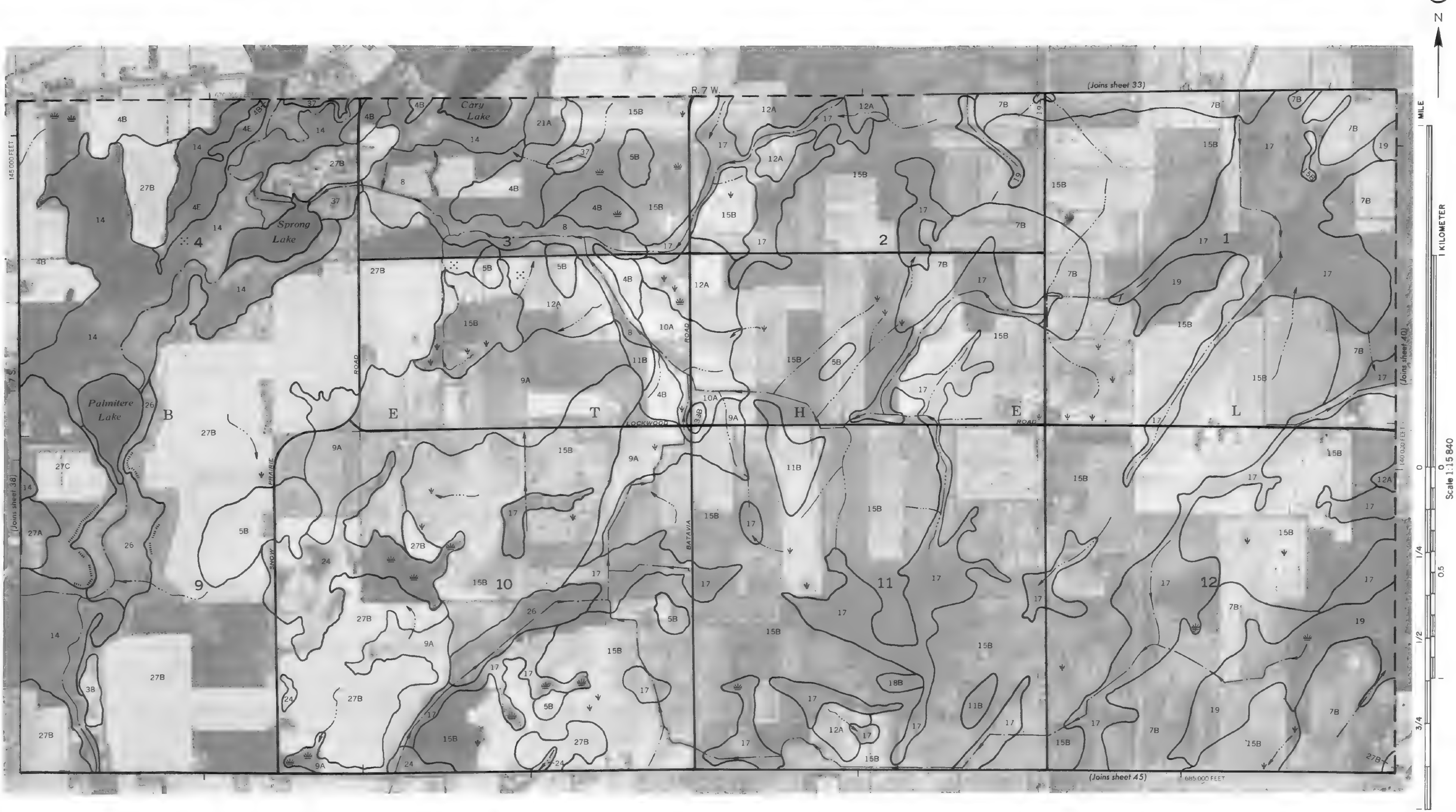

35
N
R. 6 W.
R. 5 W.
(Joins sheet 29)
(Joins sheet 41)
(Joins sheet 36)
(Joins sheet 34)
East Branch Coldwater River
COLDWATER
QUINCY
MARBLE LAKE
water
FISK ROAD
FREMONT ROAD
ROAD
26
25
30
29
35
36
31
32
1 MILE
1 KILOMETER
Scale 1:15 840

SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 36

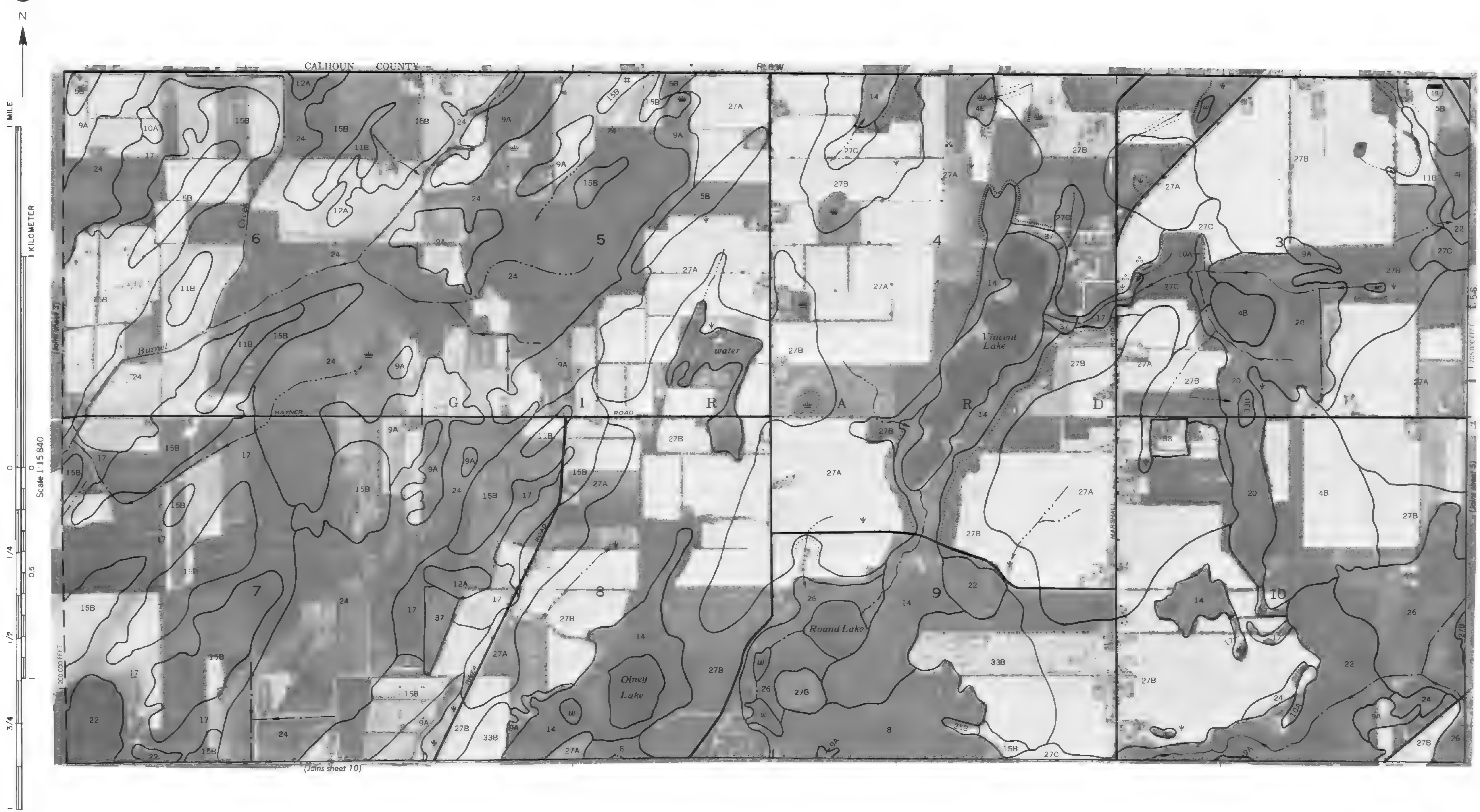



N
R. 8 W.
(Joins sheet 31)
(Joins sheet 38)
(Joins sheet 43)
B R O N S O N
Swan Creek
Swan Creek
CONRAIL
TAGGART ROAD
PRAIRIE RIVER ROAD
ROAD
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0
0.5

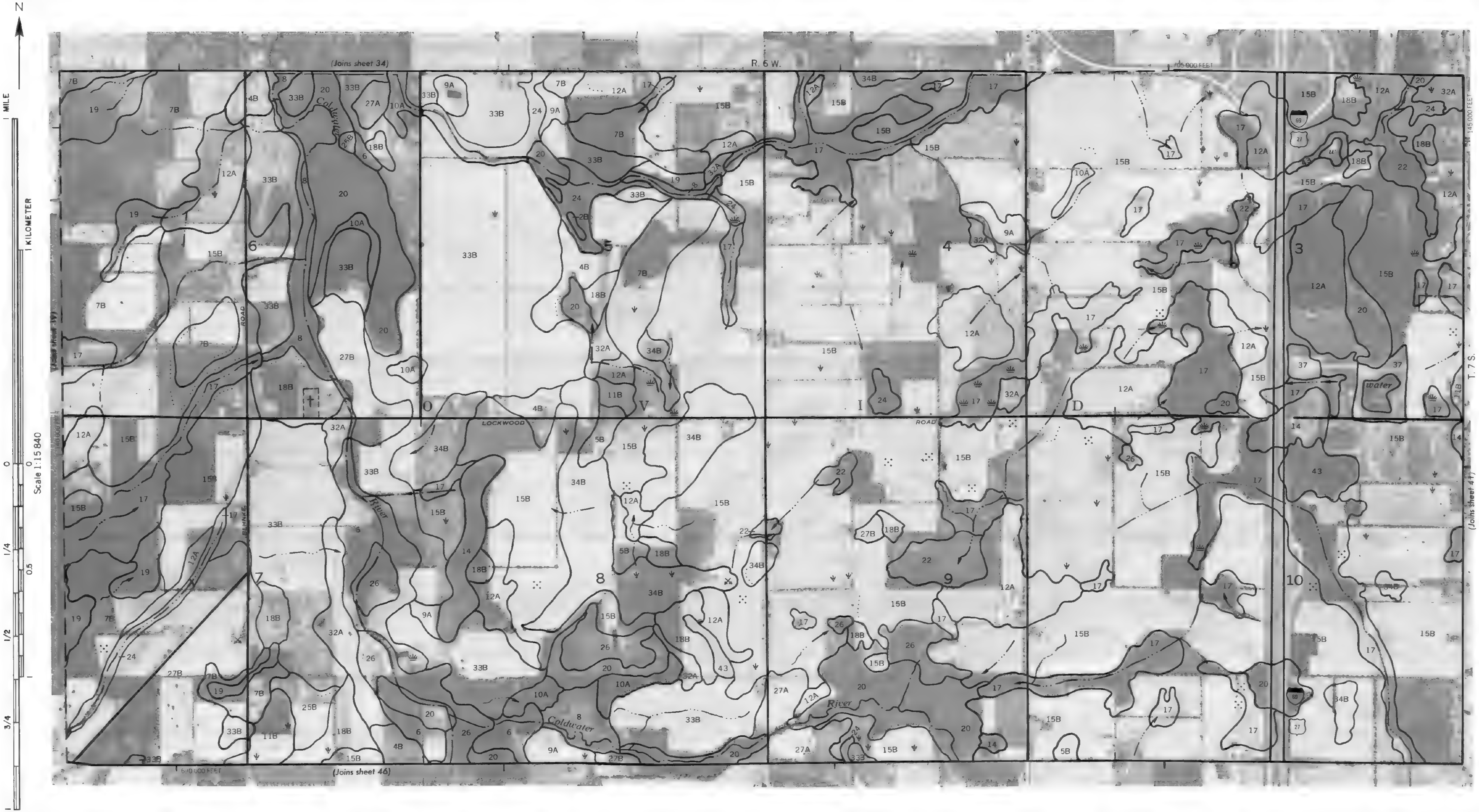

38
N
(Joins sheet 32)
R. 8 W.
R. 7 W.
665 000 FEET
Swan Creek
BRONSON
CORPORATION
CONSOLIDATED
RAIL
MATTESON LAKE ROAD
PARHAM ROAD
T. 7 S.
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 44)
145 000 FEET
135 000 FEET
550 000 FEET
water
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5


39
N
(Joins sheet 33)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 45)
R. 7 W.
T. 7 S.
670 000 FEET
145 000 FEET
140 000 FEET
685 000 FEET
Cary Lake
Sprong Lake
Palmitere Lake
ROAD
LOCKWOOD ROAD
BATAVIA ROAD
SNOW PRAIRIE
B E T H E L
MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1

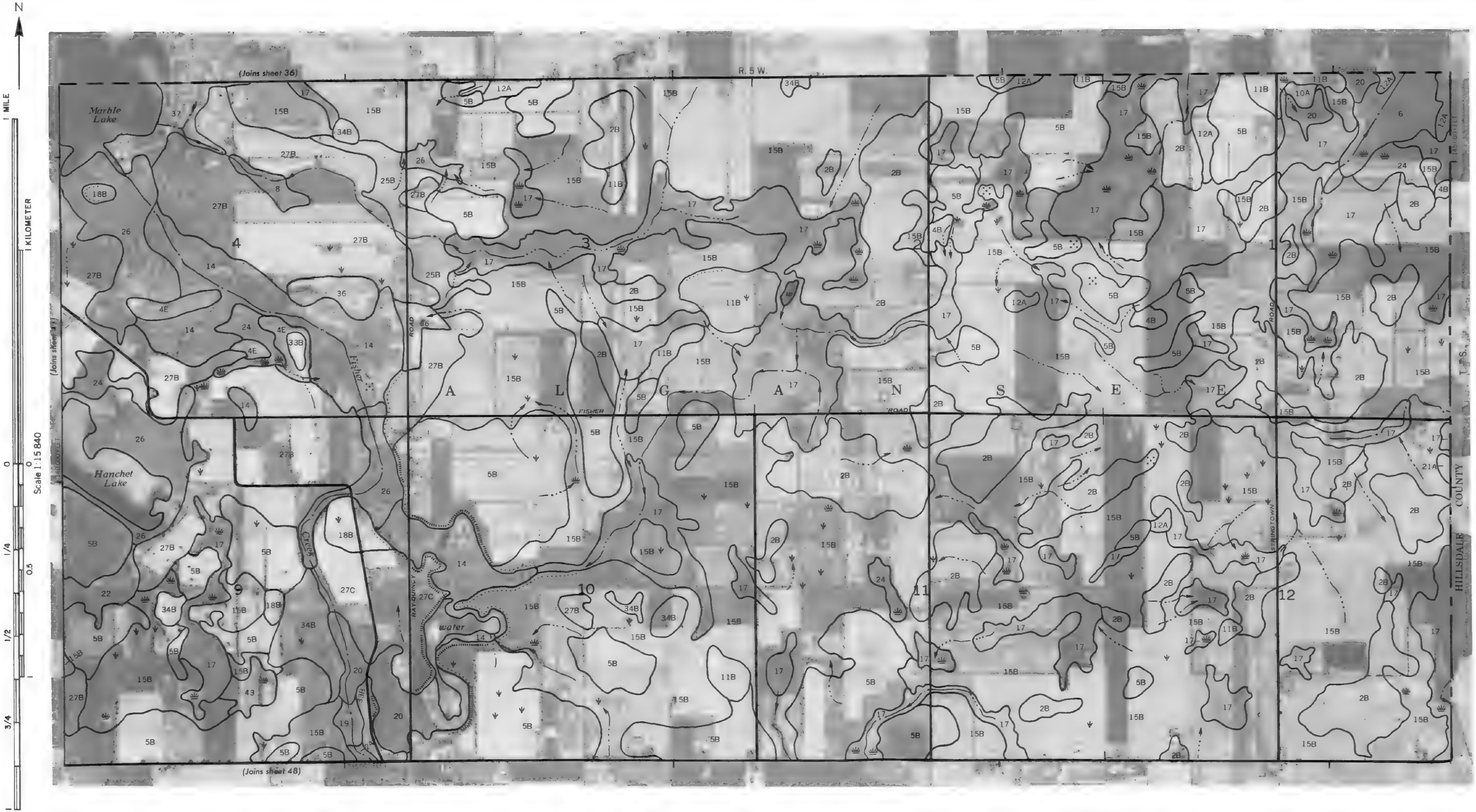
SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 4

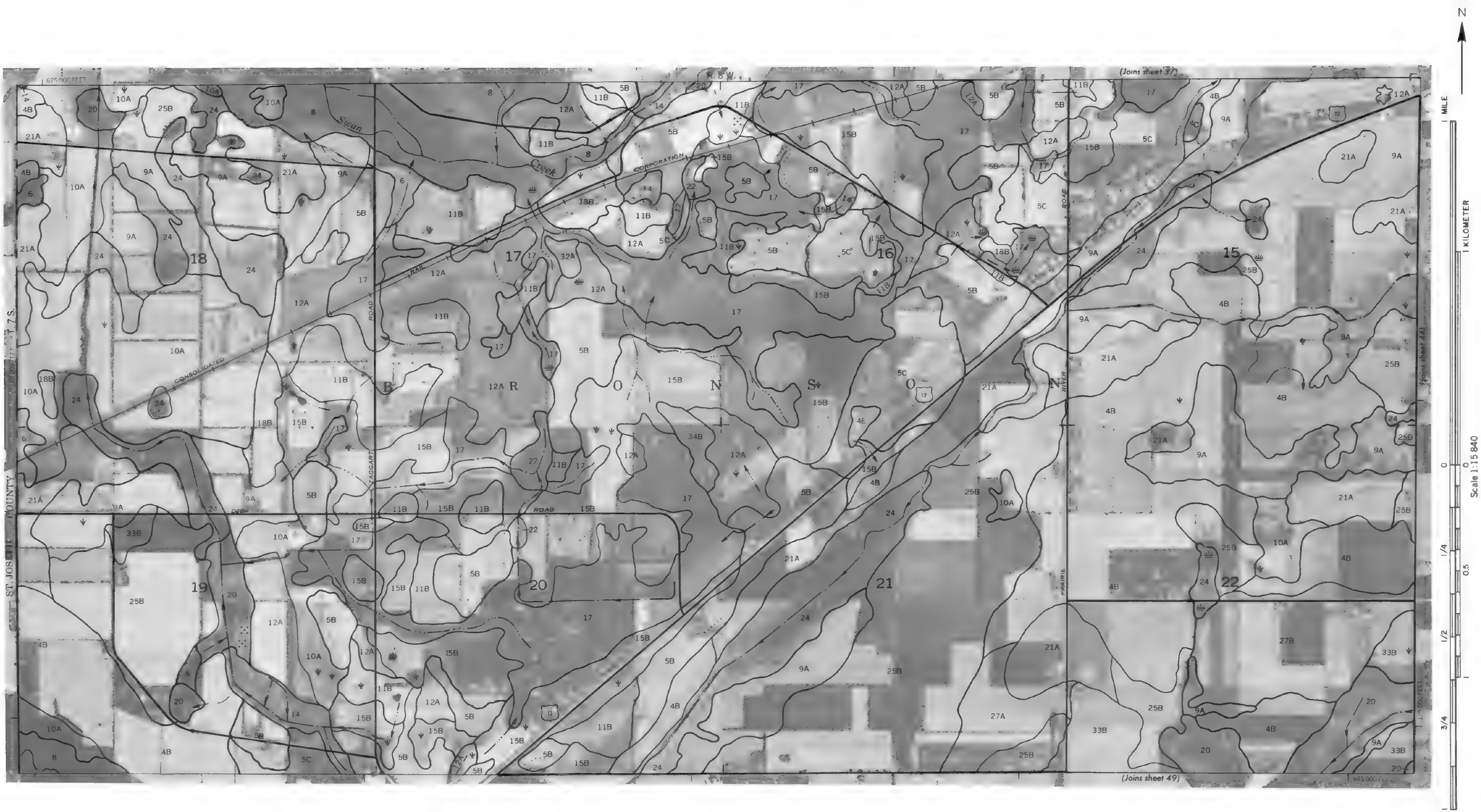


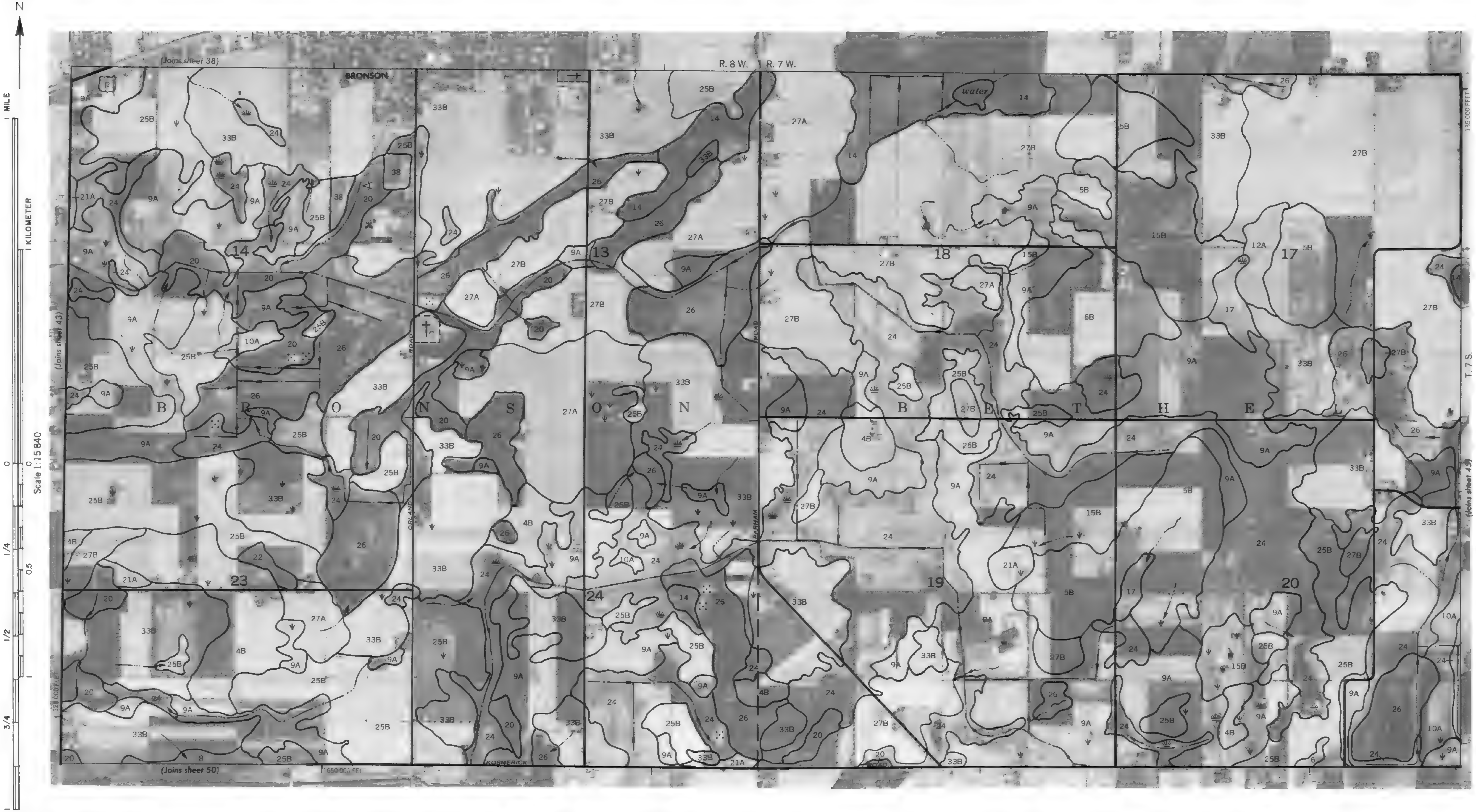
SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 40

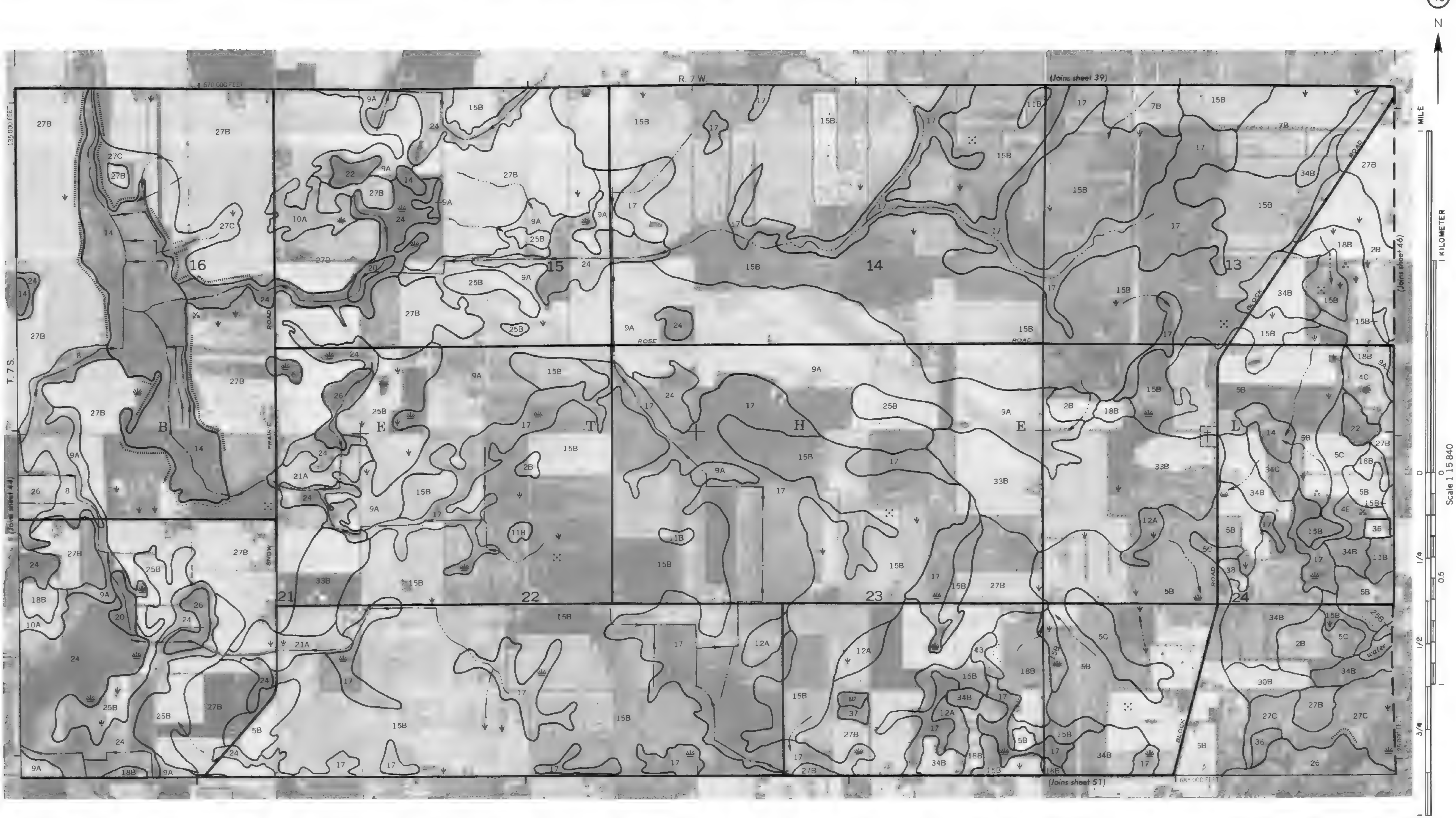


(Joins sheet 35)
(Joins sheet 47)
(Joins sheet 42)
(Joins sheet 40)
R. 6 W.
R. 5 W.
T. 7 S.
Marble Lake
Middle Lake
Hanchet Lake
Bartholemew Lake
LOCKWOOD
ROAD
QUIMBY
FREMONT
O V I D
A L G A N S E E
N
MILE
1 KILOMETER
Scale 1:15 840


N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1
(Joins sheet 36)
R. 5 W.
(Joins sheet 41)
(Joins sheet 48)
Marble Lake
Hanchet Lake
Fisher Creek
water
A L G A N S E E
FISHER ROAD
ROAD
RAYQUINCY
STRINGTOWN ROAD
HILLSDALE COUNTY
T. 8 S.
1
3
4
9
10
11
12

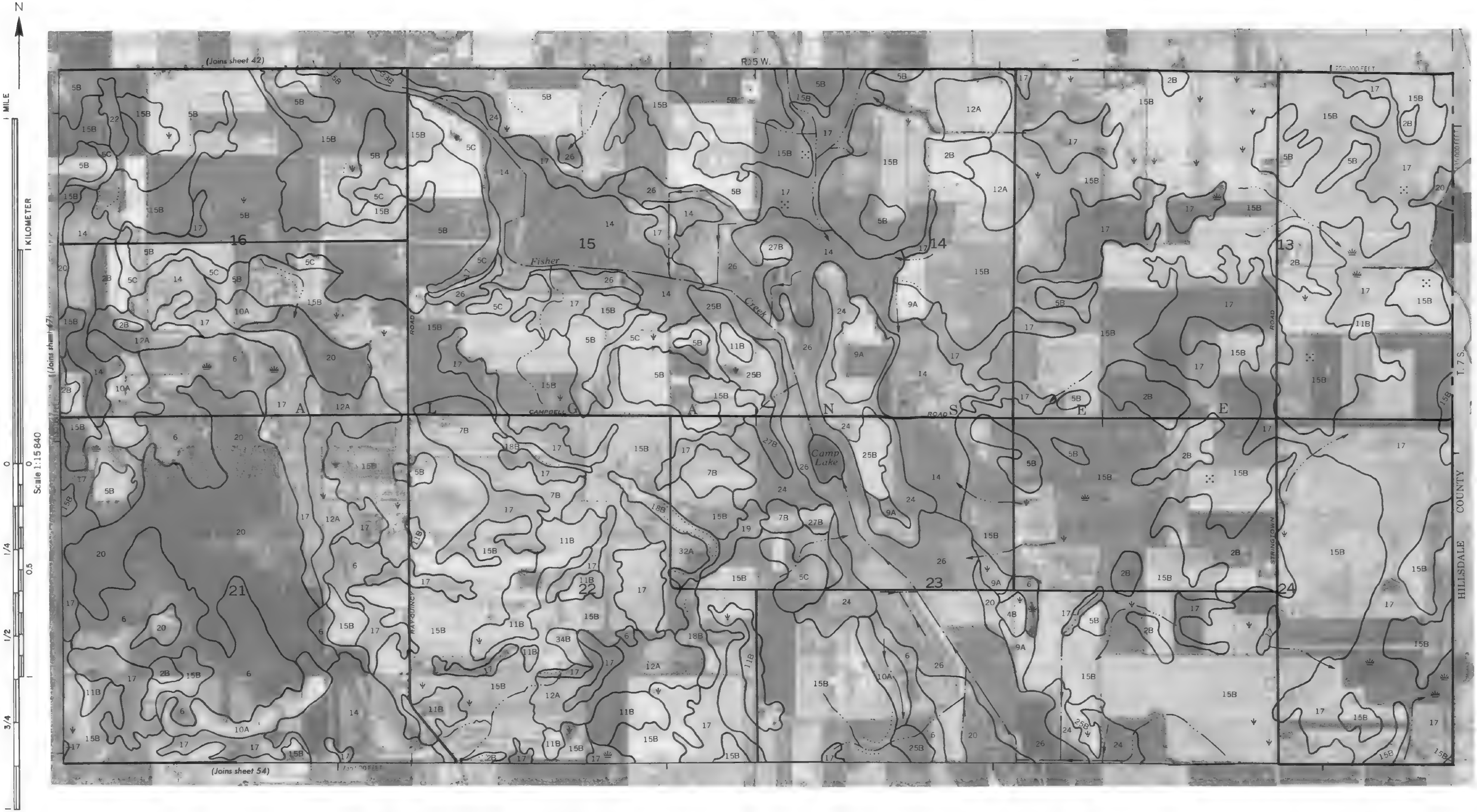

N
(Joins sheet 37)
(Joins sheet 44)
(Joins sheet 49)
R. 8 W.
T. 7 S.
ST. JOSEPH COUNTY
Swan Creek
CONSOLIDATED RAIL CORPORATION
TAGGART ROAD
DEAN ROAD
PRAIRIE RIVER ROAD
B R O N S O N
17
18
15
16
19
20
21
22
1 MILE
1 KILOMETER
Scale 1:15 840

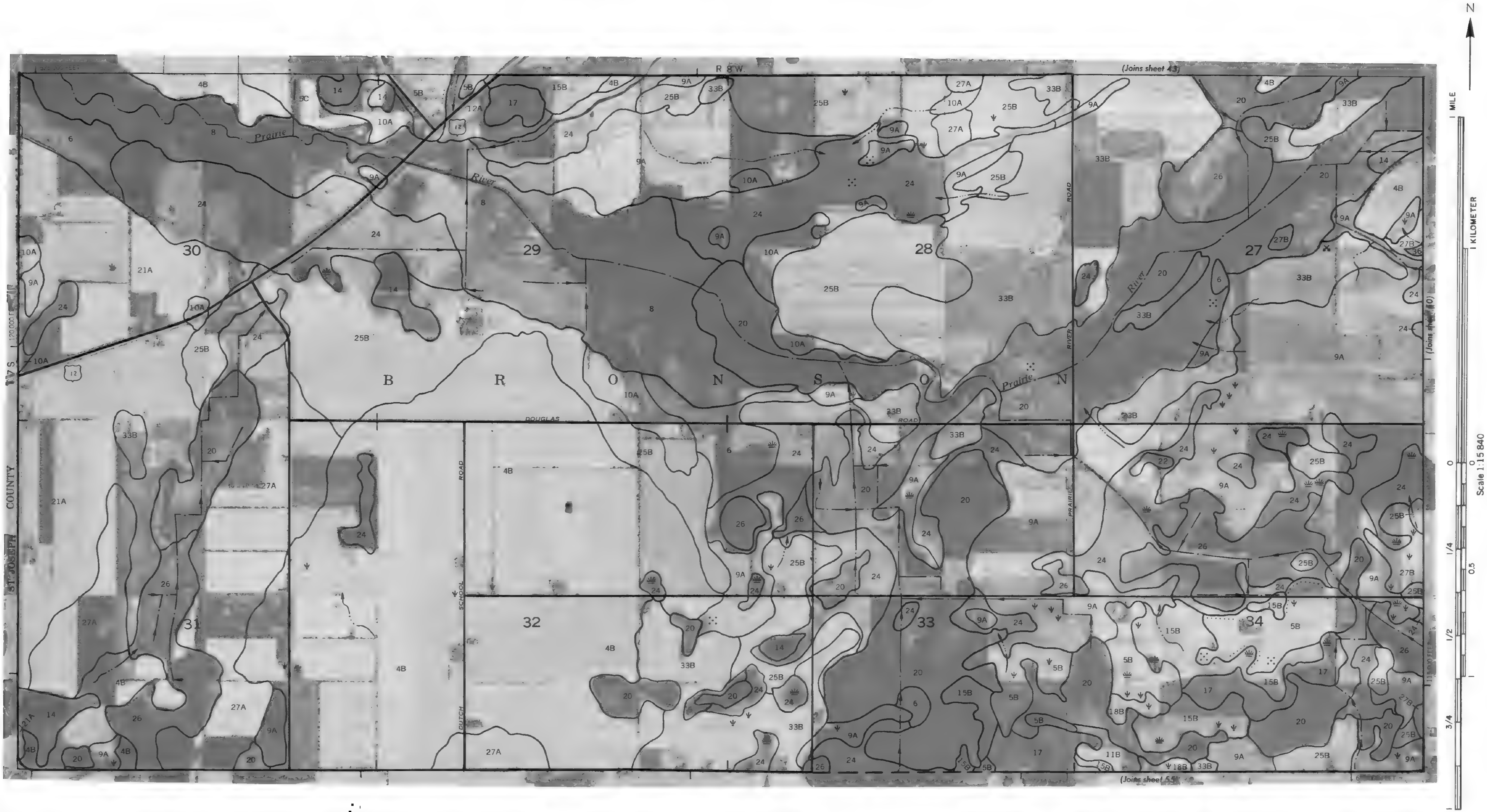

44
N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 38)
(Joins sheet 50)
(Joins sheet 43)
(Joins sheet 45)
BRONSON
R. 8 W.
R. 7 W.
T. 7 S.
B R O N S O N
B E T H E L
ORLAND ROAD
PARHAM ROAD
KOSMERICK
water


45
N
R. 7 W.
(Joins sheet 39)
(Joins sheet 46)
(Joins sheet 51)
(Joins sheet 44)
T. 7 S.
B E T H E L
16
15
14
13
21
22
23
24
ROSE ROAD
PRAIRIE ROAD
SNOW ROAD
BLOCK ROAD
water
670 000 FEET
685 000 FEET
135 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

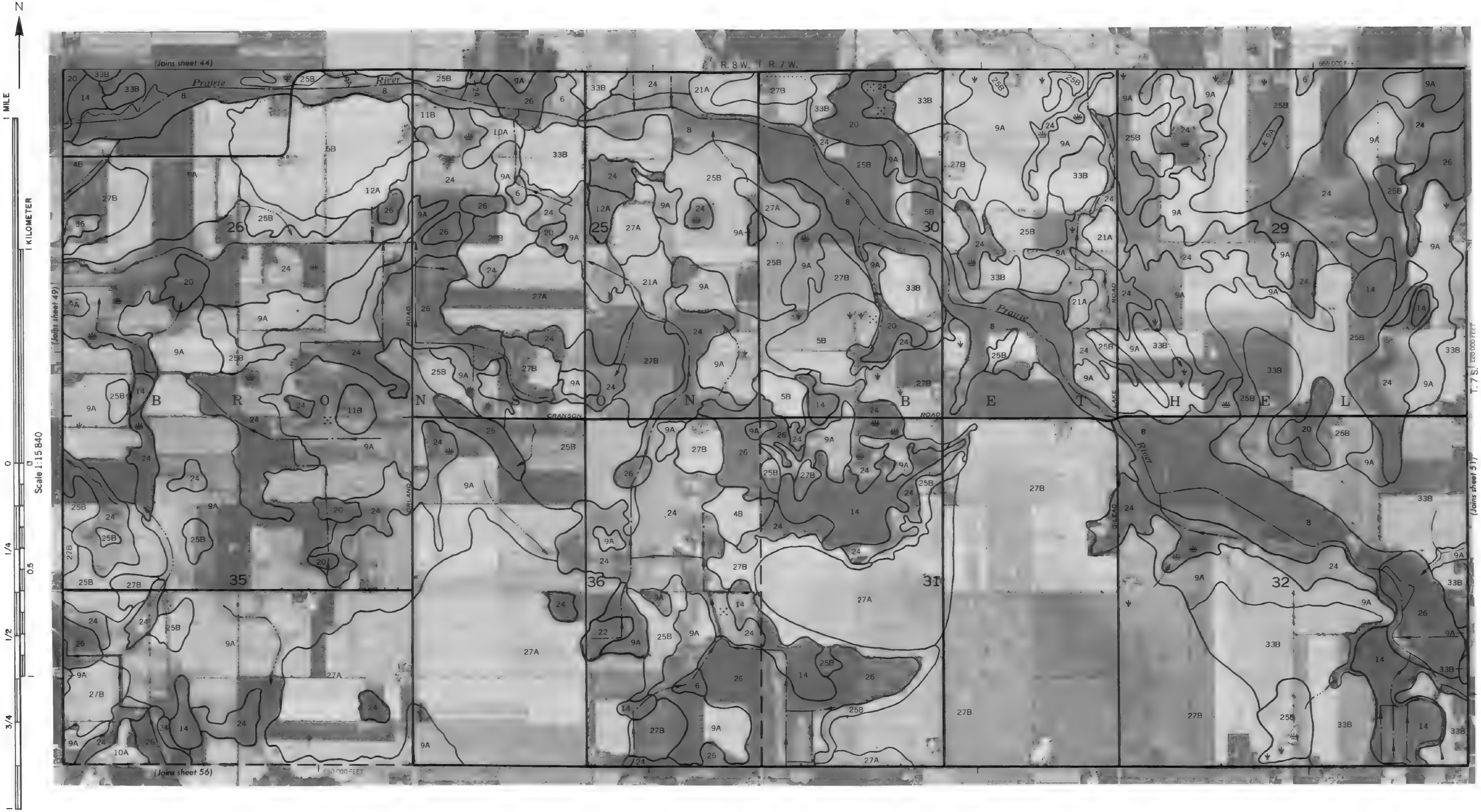
SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 46


N
(Joins sheet 41)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 53)
R. 6 W.
R. 5 W.
T. 7 S.
710 000 FEET
135 000 FEET
130 000 FEET
730 000 FEET
Loon Lake
Wright Lake
Long Lake
Coldwater Lake
Tallahassee
Creek
TALLAHASSEE
ROAD
QUIMBY
CAMPBELL
O V I D
A L G A N S E E
13
14
17
18
19
20
23
24
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1


N
1 MILE
KILOMETER
Scale 1:15 840
(Joins sheet 42)
R. 5 W.
(Joins sheet 47)
(Joins sheet 54)
T. 7 S.
HILLSDALE COUNTY
Fisher Creek
Camp Lake
CAMPBELL ROAD
RAYQUINCY ROAD
STRINGTOWN ROAD
A L G A N S E E
16
15
14
13
21
22
23
24

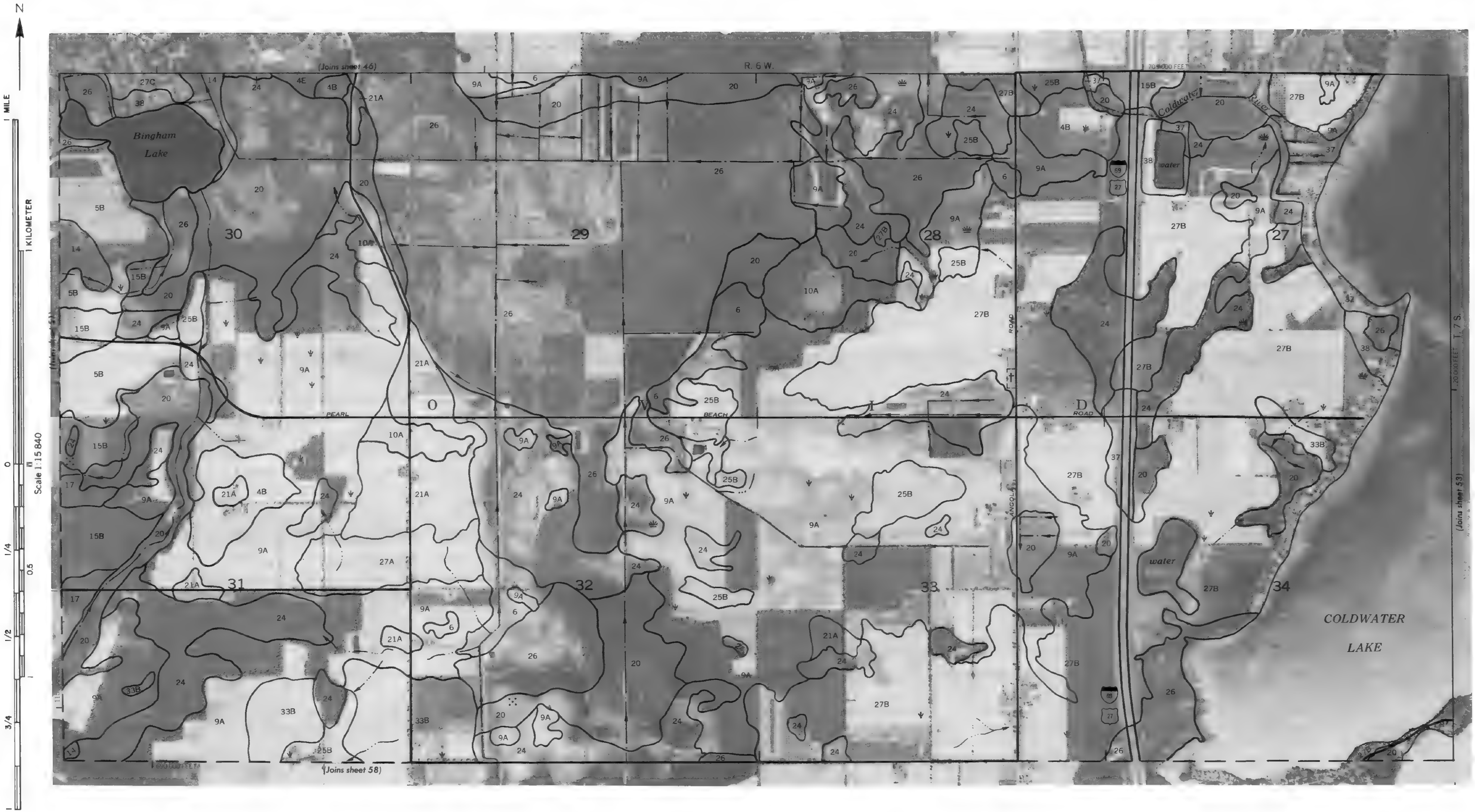

49
N
R 8 W.
(Joins sheet 43)
(Joins sheet 55)
(Joins sheet 50)
T. 7 S.
ST. JOSEPH COUNTY
B R O N S O N
Prairie River
DOUGLAS ROAD
DUTCH SCHOOL ROAD
PRAIRIE RIVER ROAD
30
29
28
27
31
32
33
34
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5

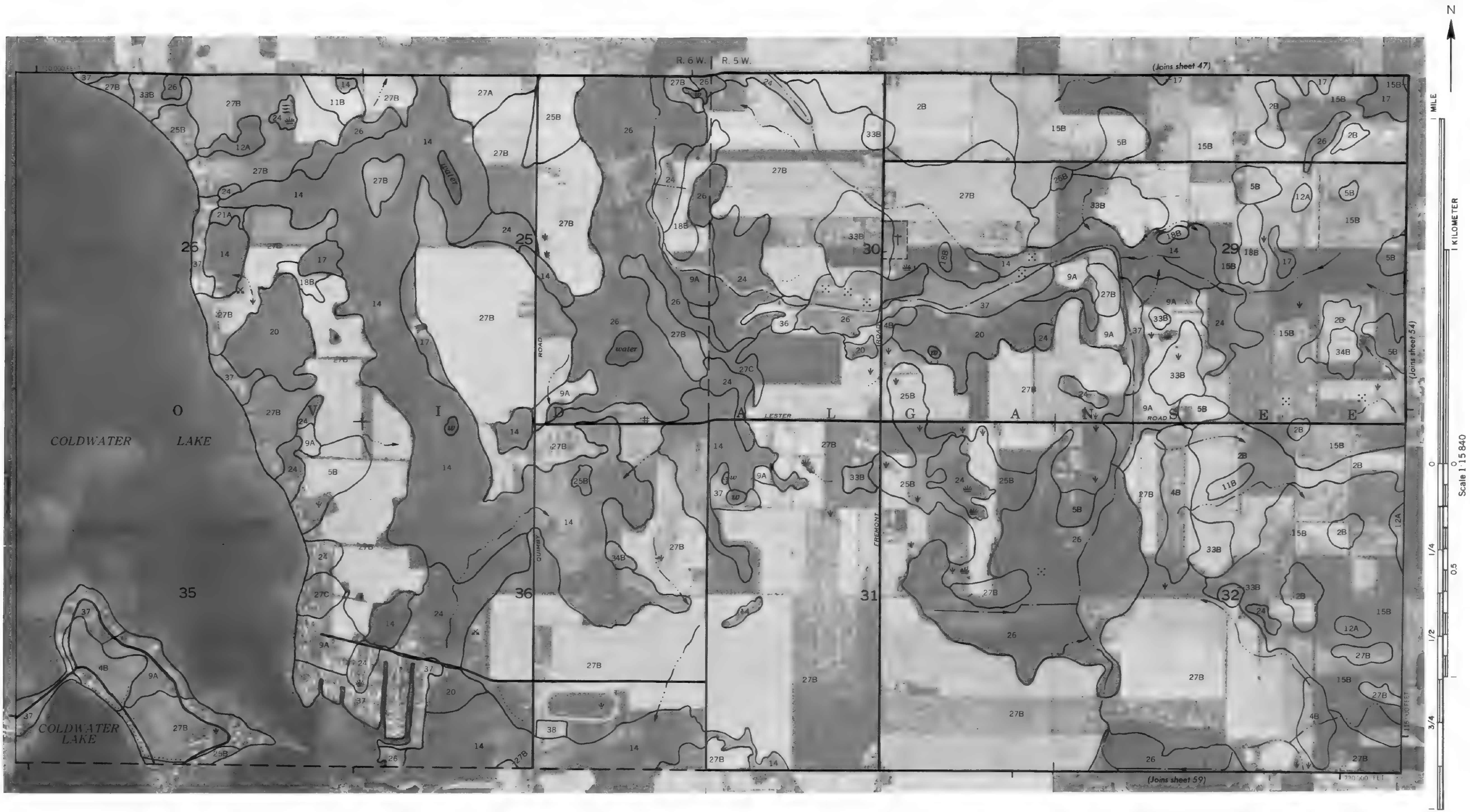

N
R. 6 W.
R. 5 W.
ST. JOSEPH COUNTY
T. 5 S.
G I R A R D
B U T L E R
Tekonsha
Creek
HERRICKVILLE
ROAD
DEAN
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 11)
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5


N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
0.5
1/2
3/4
(Joins sheet 44)
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 56)
R. 8 W.
R. 7 W.
T. 7 S.
Prairie
River
B R O N S O N
B E T H E L
CRANSON
ROAD
ORLAND
LAKE
GILEAD
26
25
30
29
35
36
31
32

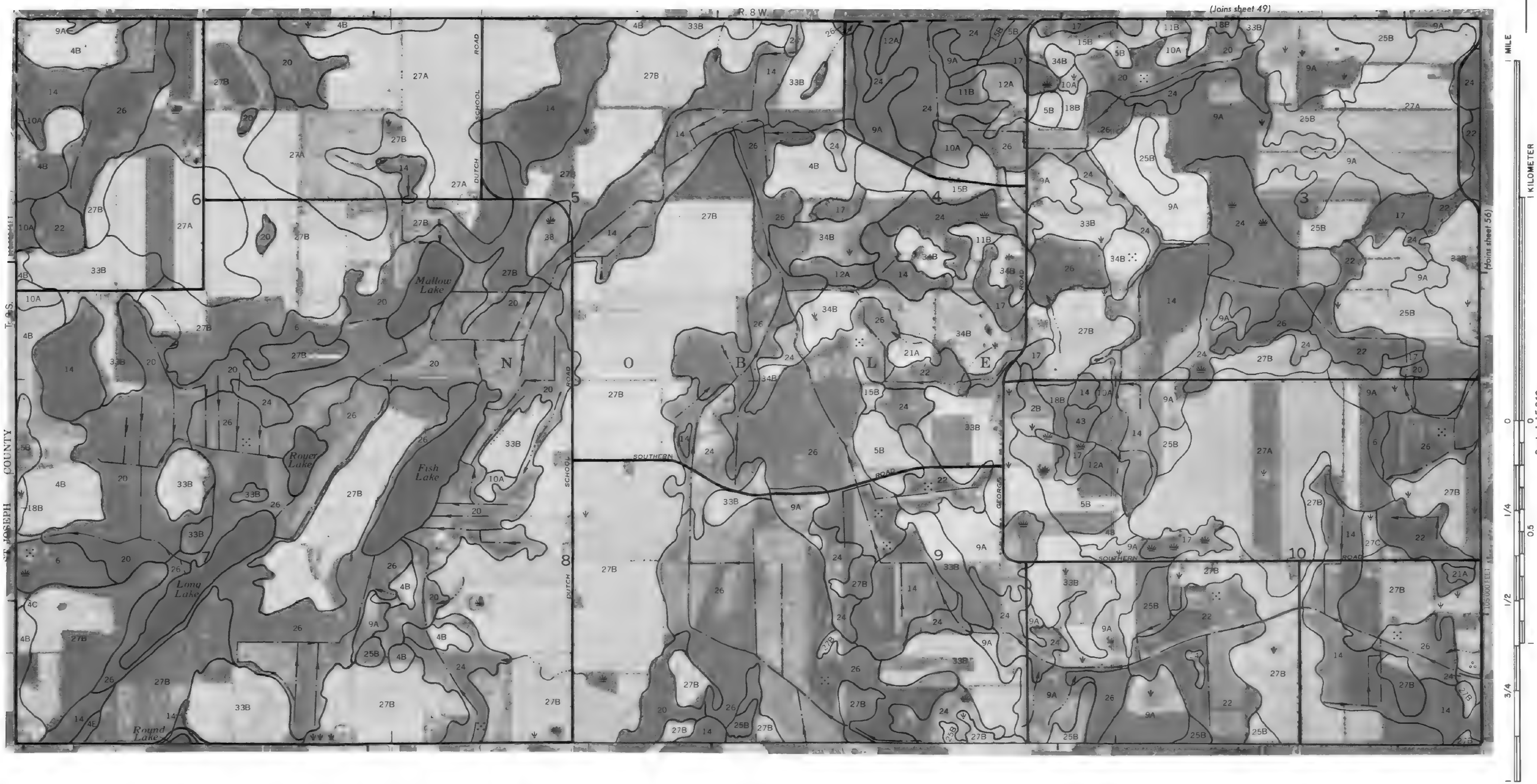
N
(Joins sheet 45)
(Joins sheet 57)
(Joins sheet 50)
(Joins sheet 52)
R. 7 W.
T. 7 S.
670 000 FEET
120 000 FEET
115 000 FEET
B E T H E L
CRANSON ROAD
CLEARWATER ROAD
BLOCK ROAD
28
27
26
25
33
34
35
36
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

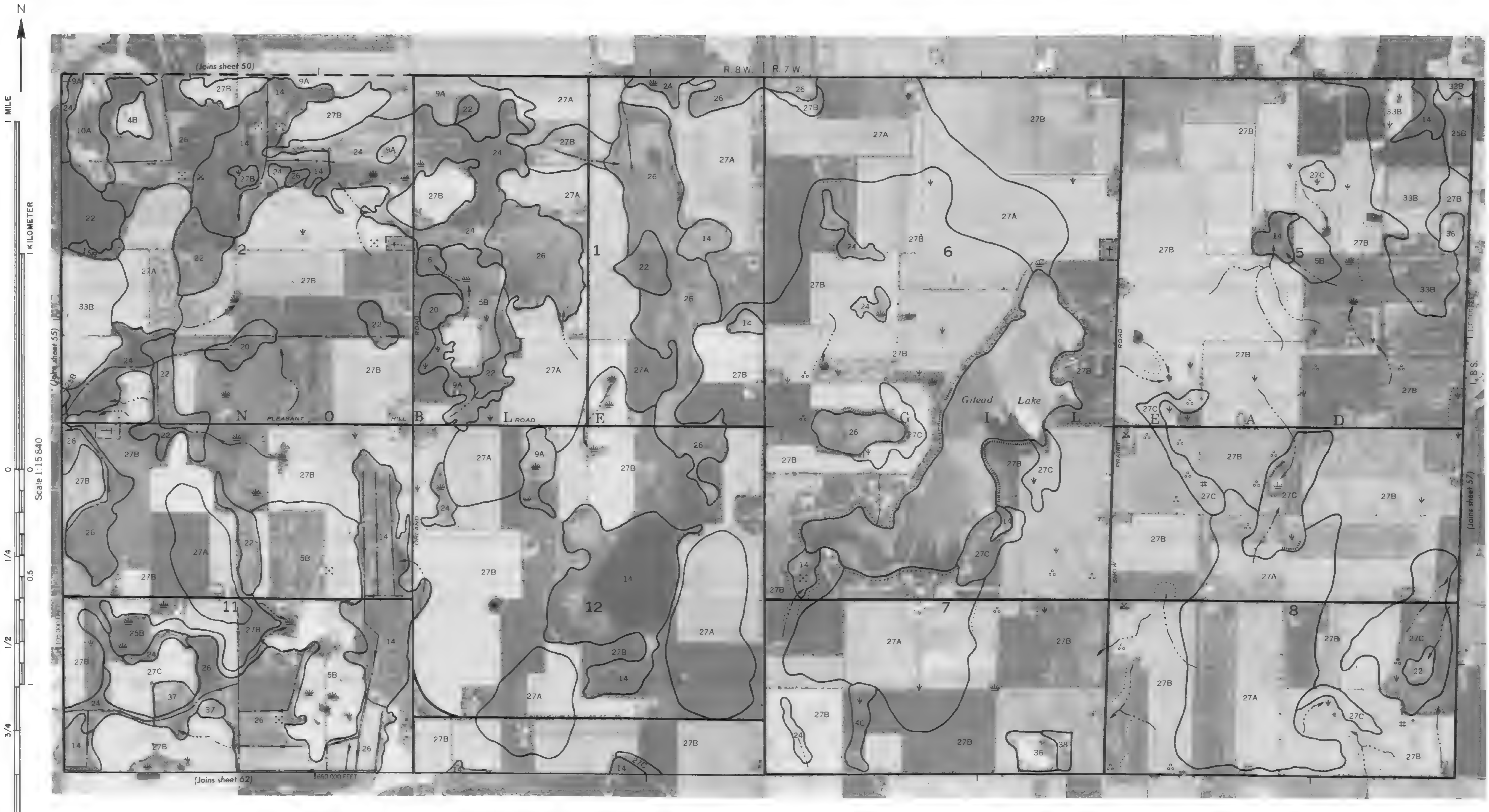
SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 52




53
N
R. 6 W.
R. 5 W.
(Joins sheet 47)
(Joins sheet 54)
(Joins sheet 59)
COLDWATER LAKE
COLDWATER LAKE
O V I D
A L G A N S E E
LESTER ROAD
QUIMBY ROAD
FREMONT ROAD
26
25
30
29
35
36
31
32
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5


N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 48)
R. 5 W.
(Joins sheet 53)
(Joins sheet 60)
Algansee
water
RAY QUINCY ROAD
LESTER ROAD
PHILLIP ROAD
A L G A N S E E
T. 7 S.
HILLSDALE COUNTY
28
27
26
25
33
34
35
36

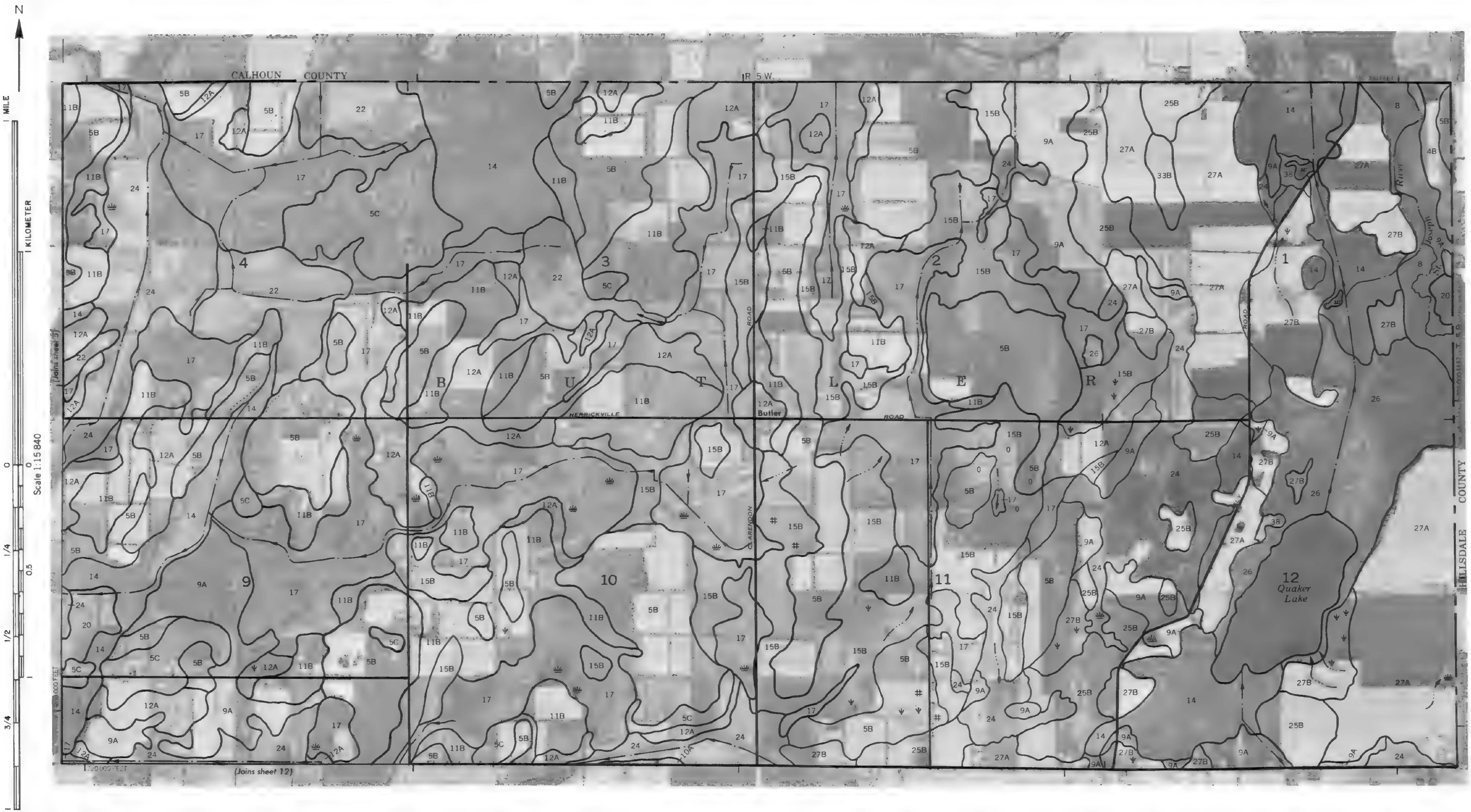

55
N
R. 8 W.
(Joins sheet 49)
(Joins sheet 56)
T. 6 S.
ST. JOSEPH COUNTY
NOBLE
Mallow Lake
Fish Lake
Rover Lake
Long Lake
Round Lake
DUTCH SCHOOL ROAD
SOUTHERN ROAD
GEORGE ROAD
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

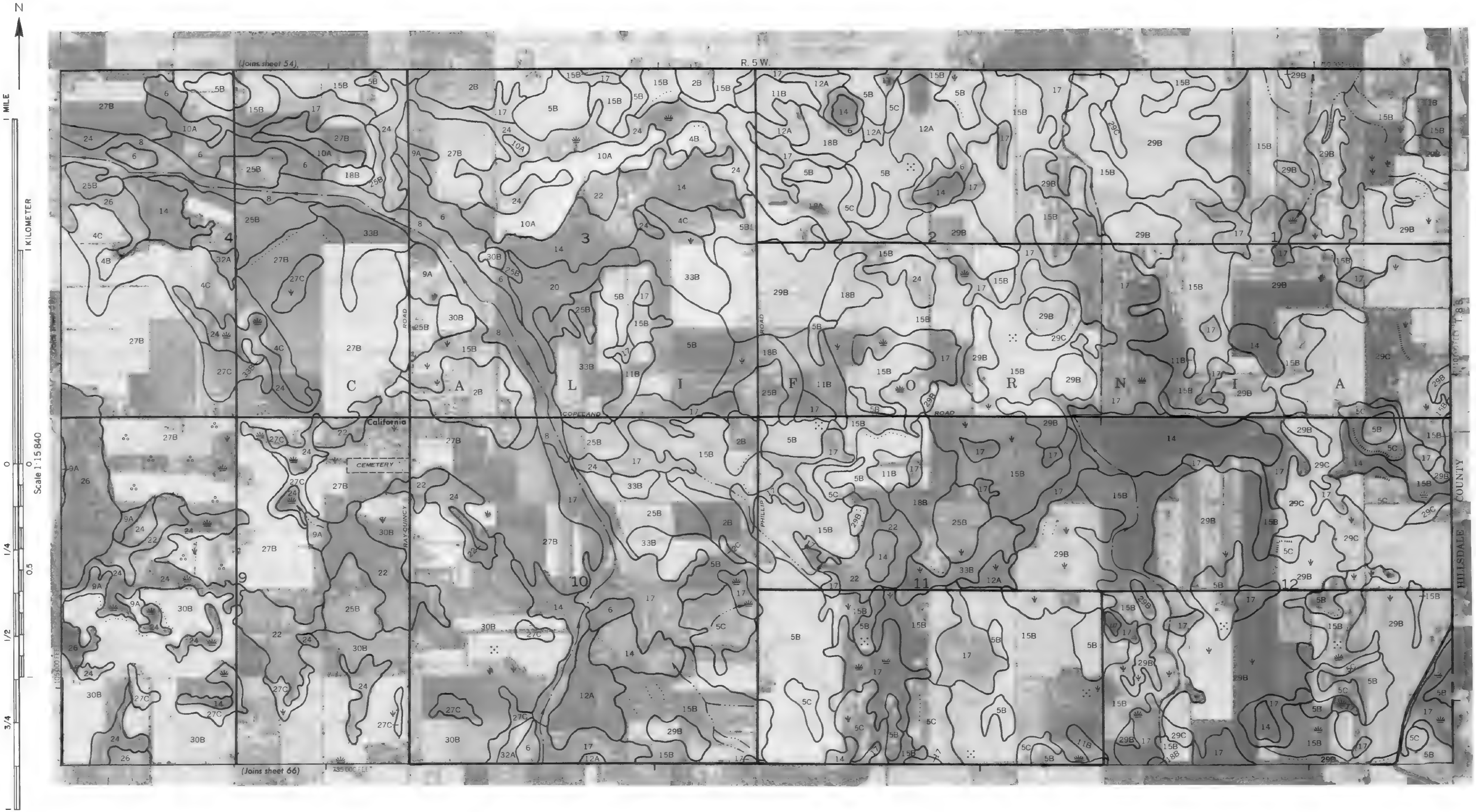

N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 50)
R. 8 W.
R. 7 W.
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 62)
650 000 FEET
PLEASANT HILL ROAD
ORLAND ROAD
PRAIRIE ROAD
SNOW
N O B L E
G I L E A D
Gilead Lake
T. 8 S.
1
2
5
6
7
8
11
12

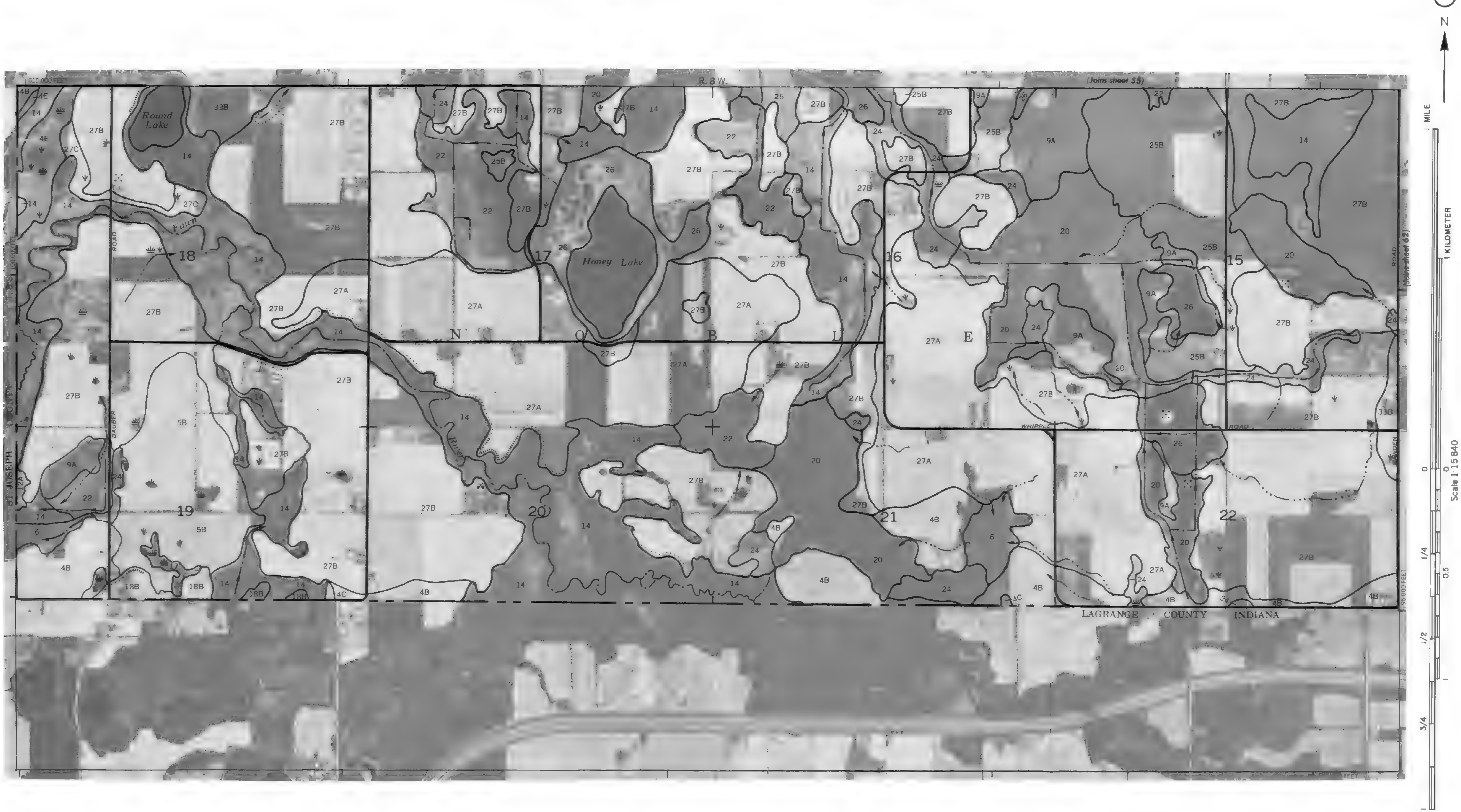

57
N
R. 7 W.
(Joins sheet 51)
(Joins sheet 58)
(Joins sheet 63)
(Joins sheet 54)
Prairie
River
ROAD
BOWERS
BOOTH
BLOCK
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1


N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 52)
R. 6 W.
(Joins sheet 57)
(Joins sheet 59)
(Joins sheet 64)
T. 8 S.
Coldwater Lake
COLDWATER LAKE
SEWAGE LAGOON
K I N D E R H O O K
Kinderhook
DRAGON LAKE ROAD
DRAGON LAKE ROAD
ANGOLA ROAD
Dragon Lake
River
Prairie
North Pleasant Lake
Silver Lake
Huyck Lake
water

N
R. 6 W.
R. 5 W.
(Joins sheet 53)
(Joins sheet 58)
(Joins sheet 60)
(Joins sheet 65)
T. 8 S.
COLDWATER LAKE
Little Cold-water Lake
water
Browns Lake
Bricker Lake
KINDERHOOK
CALIFORNIA
COPELAND ROAD
ROAD
QUIMBY ROAD
FREMONT ROAD
30 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5


N
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1
CALHOUN COUNTY
R 5 W.
(Joins sheet 5)
(Joins sheet 12)
B U T L E R
HERRICKVILLE ROAD
Butler
CLARENDON ROAD
ROAD
Quaker Lake
Joseph
River
HILLSDALE COUNTY
1
2
3
4
9
10
11
12

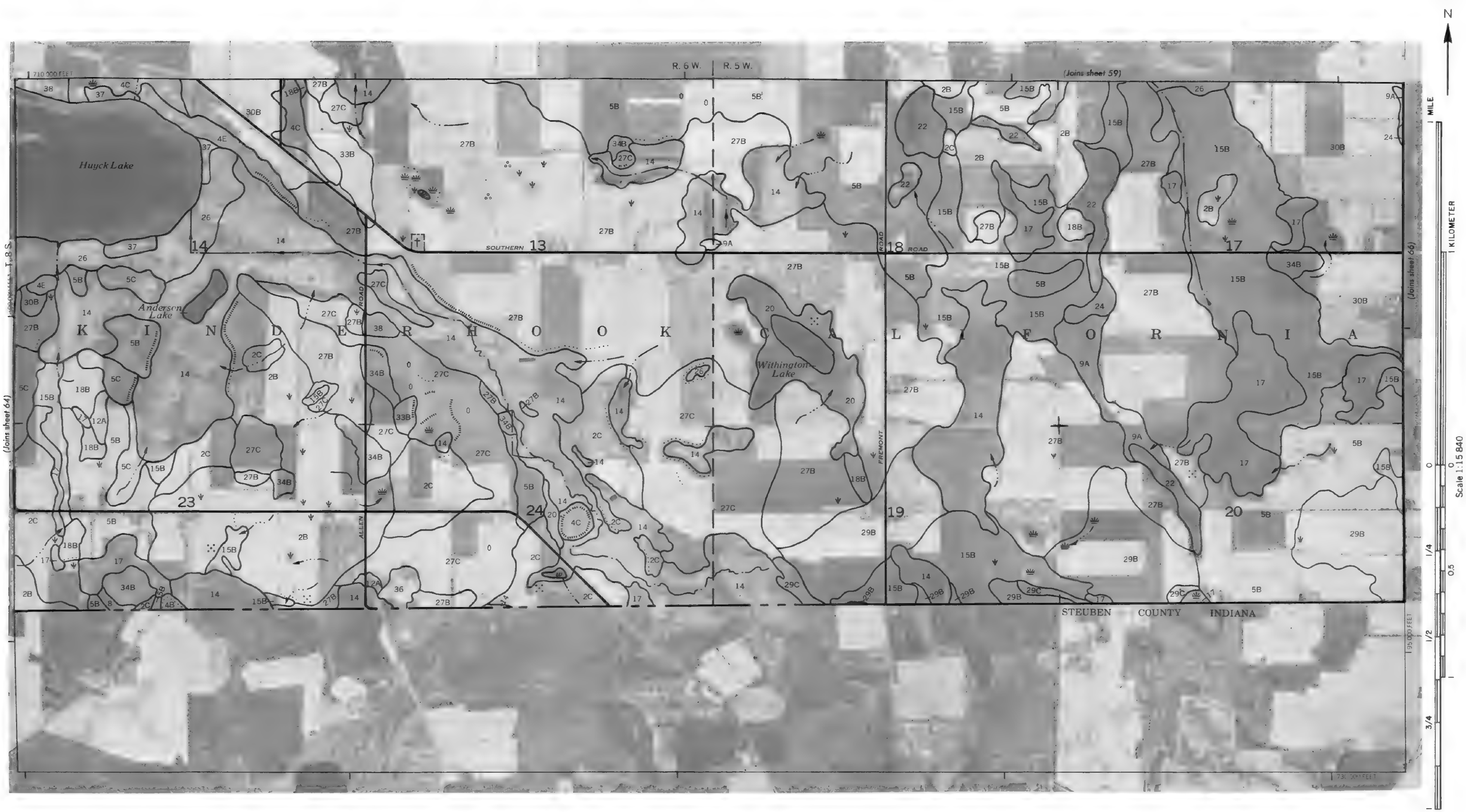

N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 54)
R. 5 W.
C A L I F O R N I A
California
CEMETERY
COPELAND ROAD
RAY-QUINCY ROAD
PHILLIPS ROAD
HILLSDALE COUNTY
(Joins sheet 66)


61
N
(Joins sheet 55)
(Joins sheet 62)
R. 8 W.
Round Lake
Honey Lake
Fawn River
N O B L E
18
17
16
15
19
20
21
22
ST. JOSEPH COUNTY
LAGRANGE COUNTY INDIANA
DAUBER ROAD
WHIPPLE ROAD
MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
1
0.5


N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 56)
(Joins sheet 63)
R. 8 W.
R. 7 W.
T. 8 S.
665 000 FEET
650 000 FEET
N O B L E
G I L E A D
WHIPPLE ROAD
ORLAND ROAD
LAKE ROAD
GILEAD
Anderson Lake
LAGRANGE COUNTY INDIANA
STEUBEN COUNTY INDIANA


63
N
R. 7 W.
(Joins sheet 57)
East Gilead
(Joins sheet 64)
(Joins sheet 62)
T. 8 S.
670 000 FEET
685 000 FEET
ADAMS ROAD
ADAMS ROAD
BOWERS ROAD
BLOCK ROAD
Lake Pleasant
Hog Lake
STEUBEN COUNTY INDIANA
G I L E A D
16
15
14
13
21
22
23
24
1 MILE
1 KILOMETER
Scale 1:15 840


N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 58)
R. 6 W.
T. 8 S.
(Joins sheet 65)
North
Pleasant
Lake
water
Lake
Latine
Silver
Lake
Huyck
Lake
LAKE
GEORGE
WHALEY
ROAD
ANGOLA
ROAD
STEUBEN
COUNTY
INDIANA
K
I
N
D
E
R
H
O
O
K
15
16
17
18
19
20
21
22
69
27


65
N
R. 6 W.
R. 5 W.
(Joins sheet 59)
(Joins sheet 64)
(Joins sheet 66)
710 000 FEET
T. 8 S.
Huyck Lake
Anderson Lake
Withington Lake
K I N D E R H O O K
C A L I F O R N I A
SOUTHERN
ROAD
ALLEN ROAD
FREMONT ROAD
13
14
17
18
19
20
23
24
STEUBEN COUNTY INDIANA
1 MILE
1 KILOMETER
Scale 1:15 840


66
N
1 MILE
1 KILOMETER
0
0
Scale 1:15 840
1/4
0.5
1/2
3/4
(Joins sheet 60)
(Joins sheet 65)
R. 5 W.
750 000 FEET
735 000 FEET
95 000 FEET
T. 8 S.
C A L I F O R N I A
STEUBEN COUNTY INDIANA
HILLSDALE COUNTY
SOUTHERN ROAD
RAY QUINCEY ROAD
CONSOLIDATED RAIL CORPORATION
KELLEY ROAD
Ray
16
15
14
13
21
22
23
24

SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 7

SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 8

SOIL MAP OF BRANCH COUNTY, MICHIGAN — SHEET NUMBER 9

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